

**1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

VOLUME: II B & III

**TECHNICAL SPECIFICATIONS
FOR
DM PLANT**

SPECIFICATION NO.: PE-TS-410-163-A001



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



TITLE:	TECHNICAL SPECIFICATION FOR		SPECIFICATION NO.: PE-TS-410-163-A001
	DM PLANT		VOLUME: II-B
	1X800 MW TSGENCO KOTHAGUDEM TPS		SECTION:
	STAGE –VII, PALONCHA		REV NO: 00 DATE:

**CONTENTS
VOLUME-IIB & III**

VOLUME-IIB

SECTION	DESCRIPTION	PAGE NO.
SECTION – A	SCOPE OF ENQUIRY	1-3
SECTION – B	PROJECT INFORMATION	4-7
SECTION – C	SPECIFIC TECHNICAL REQUIREMENTS	8-116
SECTION – C1	SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	9-20
	➤ ANNEXURE I : QUALITY PLAN	21-23
	➤ ANNEXURE II : SUB VENDORS LIST	24-35
	➤ ANNEXURE III : FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	36-51
	➤ ANNEXURE IV : DRAWING DOCUMENTS DISTRIBUTION SCHEDULE	52-54
	➤ ANNEXURE V : PAINTING SPECIFICATION	55-67
	➤ ANNEXURE VI : MANDATORY SPARES LIST	67-70
	➤ DATA SHEET-A FOR DM PLANT	71-112
	➤ P&ID FOR DM PLANT	113-114
	➤ KEY PLAN FOR DM PLANT	115-116
SECTION – C2	SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)	117-125
	➤ ELECTRICAL EQUIPMENT SPECIFICATION	118-119
	➤ ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR	120-122
	➤ ELECTRICAL LOAD DATA FORMAT	123-124
	➤ CABLE SCHEDULE FORMAT	125-125
SECTION – C3	SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)	126-129
SECTION – D	GENERAL TECHNICAL REQUIREMENT	130-617
SECTION – D1	GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	131-451
	➤ GENERAL TECHNICAL REQUIREMENT FOR DUAL MEDIA FILTERS AND DM FEED PUMPS	132-134
	➤ GENERAL TECHNICAL REQUIREMENT FOR DM PLANT	136-157
	➤ GENERAL TECHNICAL REQUIREMENT FOR LOW PRESSURE PIPING, VALVES AND SPECIALITIES	158-177
	➤ GENERAL TECHNICAL REQUIREMENT FOR LARGE DIAMETER LOW PRESSURE PIPING, VALVES AND MISC. TANKS	178-202
	➤ GENERAL TECHNICAL REQUIREMENT FOR PIPING, FITTINGS AND VALVES	203-238
	➤ GENERAL TECHNICAL REQUIREMENT FOR HORIZONTAL CENTRIFUGAL PUMPS	239-244
	➤ GENERAL TECHNICAL REQUIREMENT FOR VERTICAL CENTRIFUGAL PUMPS	245-252
	➤ GENERAL TECHNICAL REQUIREMENT FOR POSITIVE DISPLACEMENT PUMPS	253-257
	➤ GENERAL TECHNICAL REQUIREMENT FOR SUMP PUMPS, DRIVES AND ACCESSORIES	258-276
	➤ GENERAL TECHNICAL REQUIREMENT FOR SCREW PUMPS	277-286
	➤ GENERAL TECHNICAL REQUIREMENT FOR MISCELLANEOUS HOISTS	287-295
	➤ GENERAL QUALITY ASSURANCE REQUIREMENTS	296-308
	➤ GENERAL TECHNICAL REQUIREMENT FOR PROTECTIVE LINING AND PAINTING	309-322
	➤ GENERAL TECHNICAL REQUIREMENT FOR PLANT WATER SYSTEM ALONGWITH POTABLE WATER PUMPS	323-361
	➤ GENERAL TECHNICAL REQUIREMENT FOR REQUIREMENTS OF SPARES, TOOLS & TACKLE, LUBRICANTS/OIL/CONSUMABLES	362-366
	➤ GENERAL TECHNICAL REQUIREMENT FOR PERFORMANCE GUARANTEES	367-393
	➤ ADDITIONAL GENERAL TECHNICAL REQUIREMENTS	394-417
	➤ GENERAL TECHNICAL REQUIREMENT FOR ENGINEERING SERVICES	418-430
	➤ GENERAL TECHNICAL REQUIREMENT FOR PROJECT MANAGEMENT AND SITE SERVICES	431-451
SECTION – D2	GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)	452-498
	➤ GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	453-485
	➤ QUALITY PLAN (MOTOR)	486-496
	➤ EXPLANATORY NOTES FOR FILLING UP CABLE LIST	497-498
SECTION – D3	GENERAL TECHNICAL REQUIREMENT (CONTROL AND INSTRUMENTATION)	499-614



TITLE:	SPECIFICATION NO.: PE-TS-410-163-A001	
	VOLUME: II-B	
	SECTION:	
	REV NO: 00	DATE:

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

	➤ PLC SPECIFICATION	500-504
	➤ PLC DATA SHEET	505-507
	➤ PLC CONFUGRATION DIAGRAM	508-509
	➤ PLC QAP AND FAT	510-518
	➤ ACTUATOR SPECIFICATION	519-524
	➤ ACTUATOR DATASHEET	525-529
	➤ Drive Control Philosophy	530-536
	➤ UPS SCHEME	537-538
	➤ INSTRUMENTATION DATASHEET	539-569
	➤ INSTRUMENTATION QUALITY PLAN	570-575
	➤ LCP AND JB DETAILS	576-602
	➤ PC SPECIFICATION	603-605
	➤ FURNITURE SPECIFICATION	606-607
	➤ CABLE BOQ	608-609
	➤ KKS PHILOSOPHY	610-614
SECTION – D4	DRAWINGS	615-617
	P&ID OF CONDENSATE TRANSFER SYSTEM	616-616
	PLOT PLAN	617-617
VOLUME-III		618-630
	➤ SCHEDULE OF PRE BID CLARIFICATIONS	619-619
	➤ SCHEDULE OF DEVIATION WITH COST OF WITHDRAWAL	620-621
	➤ DRAWING/DOCUMENTS SUBMISSION SCHEDULE	622-626
	➤ COMPLIANCE CUM CONFIRMATION SCHEDULE	627-627
	➤ SUGGESTIVE PRICE SCHEDULE	628-629
	➤ SCHEDULE OF DECLARATION	630-630



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: A

REV NO: 00

DATE:

**SECTION – A
SCOPE OF ENQUIRY**



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: A

REV NO: 00

DATE:

1. SCOPE OF INQUIRY/ INTENT OF SPECIFICATION

- 1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trail run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of **DM PLANT** as per the details in different sections / volumes of this specification for **1X800 MW TSGENCO KOTHAGUEDEM TPS,STAGE-VII, PALONCHA**.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Condensate Polishing Units and external regeneration system.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (TSGENCO: Telangana State Power Generation Corporation Ltd.) including their consultant (Development Consultants Pvt. Ltd.) as interpreted by BHEL in the relevant context. Bidder to refer GCC/SCC for more clarity.
- 1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.



TITLE:

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: A

REV NO: 00

DATE:

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

1.13 Pre-bid meeting shall be held before bid submission. Bidder to ask all their queries in pre-bid meeting.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: B

REV NO: 00

DATE:

SECTION – B PROJECT INFORMATION



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: B

REV NO: 00

DATE:

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 would be set up by Telangana State Power Corporation Ltd. (TSGENCO) at Kothagudem, Telangana. The proposed Power Plant will be installed adjacent to the existing D colony of Kothagudem Thermal Power Station, at Kothagudem.

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

Site is located in the existing D Colony of Kothagudem Thermal Power Station, which is at a distance 30 km from temple town of Bhadrachalam and 300 km from Hyderabad by road. The Nearest railway station is Bhadrachalam Road (Known as Kothagudem) at a distance of 12 km. Kothagudem- Bhadrachalam National Highway branches off to the power station site near village Paloncha.

3.00.00 LAND

Land is primarily required for the main plant & auxiliaries (BTG) and balance of plant (BOP) like ash handling, coal storage, cooling tower, switchyard etc., which is available within the existing plant boundary.

The existing colony is to be dismantled, and the land of about 137 acres will be used for the main plant building, water facilities, switchyard, coal handling etc. The raw water reservoir will be located adjacent to the existing raw water reservoirs.

230 acres of land required for Ash Dyke will be procured. Land is available for staff colony, which is to be constructed by the EPC contractor.

4.00.00 SOURCE OF COAL

100% Imported and Blended coal (50% imported + 50% indigenous) will be used. Indigenous coal shall be sourced from Suliyari coal mines, Madhya Pradesh.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: B

REV NO: 00

DATE:

5.00.00

SOURCE OF WATER

Source of water (total quantity of water is 2192 m³/hr) is Godavari River near Burgampahad & water will be pumped through existing GRP pipe line (of length approx. 26 km).

6.00.00

ASH DISPOSAL AREA

Ash shall be dumped in the ash dump area which will be about 9 km from plant. The ash dyke area of 230 acres is adequate for 1x800 MW unit as per MOEF norms.

7.00.00

SALIENT DESIGN DATA

7.01.00

Meteorological data of site is given below:-

Elevation above MSL : 89 m

Monthly highest temperature : 44.9 °C

Monthly lowest temperature. : 12.9 °C

Rainfall

Average.: 1031 mm

Max. : 100 mm/ hr

Mean Wind speed : 5.8 kmph

Relative Humidity

Max : 82%

Min : 35%

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

[Climatological data of Khammam is attached for reference].



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: B

REV NO: 00

DATE:

ANALYSIS OF CLARIFIED WATER (TO BE USED TO DESIGN THE DM PLANT)

CONSTITUENTS	As	CONTENT
Calcium	CaCO ₃	128.9 ppm
Magnesium	CaCO ₃	53.52 ppm
Sodium	CaCO ₃	73.44 ppm
Potassium	CaCO ₃	1.02 ppm
Iron in Soln.	Fe	0.1 ppm
Hydrogen (FMA)	CaCO ₃	- ppm
TOTAL CATIONS (except iron)	CaCO ₃	256.88 ppm
Bicarbonate	CaCO ₃	143.4 ppm
Carbonate	CaCO ₃	0.53 ppm
Hydroxide	CaCO ₃	0.02 ppm
Sulphate	CaCO ₃	59.85 ppm
Chloride	CaCO ₃	50.82 ppm
Nitrate	CaCO ₃	1.21 ppm
Phosphate	CaCO ₃	- ppm
Fluoride	CaCO ₃	1.05 ppm
TOTAL ANIONS	CaCO ₃	256.88 ppm
Reactive Silica	SiO ₂	10 ppm
Total Suspended Solid	CaCO ₃	15 ppm (overload condition)
Conductivity at 25 deg C		450 Microsiemens/cm (max)
pH value at 25 ⁰ C	-	7.62
Turbidity		Not to exceed 15 NTU (max)



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C

REV NO: 00

DATE:

SECTION – C SPECIFIC TECHNICAL REQUIREMENTS



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

SECTION-C1

SPECIFIC TECHNICAL REQUIREMENT MECHANICAL



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

1.0 GENERAL

The DM Plant and associated accessories shall conform to the technical specification.

2.0 SCOPE OF SUPPLY (MECHANICAL)

Broad scope of supply (mechanical) for this package is detailed below and as indicated in relevant portion of this specification. Please refer Electrical and C&I specifications also for respective scope of Electrical and C&I items:

The DM Plant, as specified in Technical data sheets & technical specifications, and shall consist of at least the followings:

- 1) Three (3) numbers (3X50%) (2Working+2Standby) DM Feed pumps along with motors, piping, valves, fittings, instrumentation & all other accessories as required.
- 2) Three (3) numbers (3X50%) (2Working+1Standby) Dual Media Pressure Filter Units, each complete with internals, integral pipe works, valves, filter media, fittings, instrumentation and all other accessories as required.
- 3) Two (2) numbers (2X100%) (1Working+1Standby) Air Blowers for Dual Media Pressure Filter Units, along with suction filter, silencer, motors, acoustic hood, piping, valves, fittings, instrumentation and all other accessories as required.
- 4) Complete valves, fittings, instrumentation and all other accessories required for one (1) no. Overhead Backwash Water Storage Tank for Dual Media Pressure Filter Units.
- 5) Two (2) numbers (2X100%) (1Working+1Standby) Activated Carbon Filters each complete with internals, integral pipe works, valves, activated carbon, fittings, instrumentation and all other accessories as required.
- 6) Two (2) numbers (2X100%) (1Working+1Standby) Weakly Acid Cation Exchangers along with ion exchange resin, integral pipe works, internals, resin traps, valves, fittings, instrumentation, and accessories associated with the same.
- 7) Two (2) numbers (2X100%) (1Working+1Standby) Strong Acid Cation Exchangers along with ion exchange resin, integral pipe works, internals, resin traps, valves, fittings, instrumentation, and accessories associated with the same.
- 8) Two (2) numbers (2X100%) (1Working+1Standby) forced draft Degasser Towers [One (1) nos. on each Degassed Water Storage Tank] along with internals. integral pipe works, valves, fittings, instrumentation and accessories associated with the same.
- 9) Three (3) numbers (3X50%) (2Working+1Standby) Degasser Air Blowers along with suction filter, silencer, motors, acoustic hood, piping, valves, fittings, instrumentation and all other accessories as required.
- 10) Two (2) numbers (2X100%) (1Working+1Standby) Degassed Water Storage Tank along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 11) Three (3) numbers (3X50%) (2Working+1Standby) Degassed Water Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 12) Two (2) numbers (2X100%) (1Working+1Standby) Weak Base Anion Exchangers along with ion exchange resin, resin trap, integral pipe works, internals, valves, fittings, instrumentation and accessories associated with the same.
- 13) Two (2) numbers (2X100%) (1Working+1Standby) Strong Bases Anion Exchangers along with ion exchange resin, resin trap, integral pipe works, internals, valves, fittings, instrumentation and accessories associated with the same.
- 14) Two (2) numbers (2X100%) (1Working+1Standby) Mixed Bed Exchangers along with ion exchange



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

resin, resin trap, integral pipe works, internals, valves, fittings, instrumentation accessories associated with the same.

- 15) Two (2) numbers (2X100%) (1Working+1Standby) Air Blowers for Mixed Bed Exchangers (common for Neutralization Pit) along with suction filter, silencer, motors, acoustic hood, piping, valves, fittings, instrumentation and all other accessories as required.
- 16) Two (2) nos of hose stations for unloading of Hydrochloric Acid. The hose station shall have two (2) nos of 80 mm NB flexible hose connection.
- 17) Two (2) numbers (2X100%) (1Working+1Standby) Hydrochloric Acid Unloading Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 18) Two (2) nos Bulk Hydrochloric acid Storage Tanks along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 19) Two (2) nos Hydrochloric acid Measuring Tanks for Cation Exchangers along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 20) One (1) no. Hydrochloric acid Measuring Tanks for Mixed Bed Exchangers along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 21) One (1) no. Hydrochloric acid Measuring Tanks for Neutralisation at NPIT along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 22) Two (2) nos Hydrochloric Acid Dosing ejectors for Cation Exchangers along with accessories. Both water and acid shall be thoroughly mixed in the ejector.
- 23) One (1) no. Hydrochloric Acid Dosing ejectors for Mixed Bed Exchanger along with accessories. Both water and acid shall be thoroughly mixed in the ejector.
- 24) Two (2) nos of hose stations for unloading of Caustic. The hose station shall have two (2) nos of 80 mm NB flexible hose connection.
- 25) Two (2) numbers (2X100%) (1Working+1Standby) Caustic Unloading Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 26) Two (2) nos Bulk caustic Storage Tanks along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 27) One (1) no. Activated Carbon Filter for caustic each complete with internals, integral pipe works, valves, activated carbon, fittings, instrumentation and all other accessories as required.
- 28) Two (2) nos Caustic Measuring Tanks for Anion Exchangers along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 29) One (1) no. Caustic Measuring Tanks for Mixed Bed Exchangers along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 30) One (1) no. Caustic Measuring Tanks for Neutralisation at NPIT along with piping, valves, fittings, instrumentation and accessories associated with the same.
- 31) One (1) no. Brine solution preparation Tanks along with agitators, agitator motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 32) One (1) no. Hot Water Tank along with Regeneration Water heaters, piping, valves, fittings, instrumentation and accessories associated with the same.
- 33) Two (2) numbers (2X100%) (1Working+1Standby) Alkali Transfer cum Recirculation Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 34) Two (2) nos Caustic Dosing ejectors for Anion Exchangers along with accessories. Both water and Caustic shall be thoroughly mixed in the ejector.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

- 35) One (1) no. Caustic Dosing ejectors for mixed bed Exchangers along with accessories. Both water and Caustic shall be thoroughly mixed in the ejector.
- 36) Two (2) numbers (2X100%) (1Working+1Standby) Potable water Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 37) Two (2) numbers (2X100%) (1Working+1Standby) DM Regeneration water Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 38) Neutralization Pit (RCC- By BHEL). However instrumentation, piping, valves, fittings and accessories associated with the same shall be in bidder's scope.
- 39) Two (2) numbers (2X100%) (1Working+1Standby) Neutralized Effluent Disposal Pumps along with motors, piping, valves, fittings, instrumentation and accessories associated with the same.
- 40) Safety equipments as per Data Sheet-A.
- 41) Two (2) nos. safety shower near acid/ caustic storage tanks.
- 42) One (1) no. Central Sampling Rack (to be located at express laboratory to be located at ground floor of DM Plant building).
- 43) First fill of filter media, resin, and degasser tower packings for all the units complete with make-up filter media, resin and packings for first three years of operation. Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively. For filter make-up a loss of 10% per annum shall be considered.
- 44) All vessels as per P&ID & Data Sheet-A complete with inlet and outlet connections, bed support cum under drain system, inlets water distributors, all fittings and appurtenances etc. as specified and as required.
- 45) External resin/media traps at the outlet of each of the vessels, designed for in place manual backwashing.
- 46) All tanks as per P&ID & Data Sheet-A complete with inlet and outlet connections, drain system, inlets water connection, all fittings and appurtenances etc. as specified and as required.
- 47) Bidder to note that the equipment, valves, instruments indicated in the P&ID (PE-DG-410-163-A001) attached in the technical specification are minimum and are in bidder's scope. During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, equipment's etc. for smooth, safe, efficient and trouble free operation of the plant meeting the specification requirement and also considering the applicable statutory requirement.
- 48) Necessary piping, fitting, valves, drains, vents, sampling etc. required for the complete DM Plant. Pipe racks shall be provided by BHEL wherever available, wherever pipe racks are not available, pipe shall be laid on pedestal to be provided by BHEL. However all auxiliary steel structure (U-clamps, nuts, bolts, channels etc) for fixing pipes on pedestal or racks shall be in bidder's scope.
- 49) All insert plates, rung ladder, nuts and bolts, and flanges and matching counter flanges wherever applicable.
- 50) All necessary valves and fittings for the installations with the actuators necessary for their remote operation.
- 51) Embedment plates with lugs shall also be provided by bidder as per system requirement.
- 52) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.
- 53) Start-up and commissioning spares as required.
- 54) Mandatory spares as indicated elsewhere in the specification.
- 55) All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

- box. Operating platforms, permanent ladders (not rugs), supports and other structural works for each tanks, valves etc. to facilitate accessibility for operation and maintenance.
- 56) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with DM Plant.
 - 57) Finish paints for touch up painting of equipments after erection at site in sealed container.
 - 58) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.
 - 59) All pipes, fittings etc required for hand railing, platforms, and ladders shall be in the scope of bidder.
 - 60) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanised using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and
 - 61) 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.
 - 62) Monitoring gadgets, instruments and equipments required for commissioning & maintenance (till PG test and plant handover).
 - 63) Instrument hook up material shall be in bidder's scope.
 - 64) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.
 - 65) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All auxiliary structure & fixing items such as U clamps, nuts, bolts, channels, insert plates etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Wrapping, coating and protection of all the buried pipe is also in bidder's scope.
 - 66) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.
 - 67) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.
 - 68) All other items are also included in scope of supply as specified in other part of the specification.
 - 69) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ during detail engineering
 - 70) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.
 - 71) Initial fill of resins, media and degasser tower packing for all vessels as required.
 - 72) One no. Electric Hoist with Monorail of minimum 1000 kg capacity. Capacity of hoists shall be selected considering a minimum margin of 10% over the maximum weight of the heaviest equipment / component to be handled by the Hoist.
 - 73) All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids etc. which will be required to put the equipment covered under the scope of



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

specifications, into successful commissioning / initial operation and to establish completion of facilities shall be in bidder's scope. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

- 74) All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.
- 75) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs for mechanical plant and equipment, mechanical services and pipe work associated with Effluent Treatment Plant.
- 76) All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose

3.0 PIPING

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges Hangers and supports, embedment plates with lugs etc required for the below given piping shall also be provided by the bidder.

- 1) All piping within the DM Plant and potable water treatment plant.
- 2) Inlet and outlet pipes for each vessel, pumps, other equipments, etc. with pipe connections to the respective vessels/equipments.
- 3) 800 meter DM plant feed piping from Clarified water pump house where (DM Feed pumps are located) to DM plant. For details, please refer plot plan.
- 4) 200 meter DM water piping from DM plant to DM Water storage tanks.
- 5) 200 meter DM water recirculation piping from DM water regeneration pumps to each DM Water storage tanks.
- 6) 80 meter DM water piping from common suction header of DM Water storage tanks to DM water regeneration pumps. For details pls refer P&ID for Condensate transfer system (PE-DG-410-100-N109 REV 01) attached elsewhere in the specification.
- 7) 1100 meter filter back wash water piping from filter back wash sump in DM plant area to stilling chambers in PT plant area.
- 8) 1300 meter neutralize effluent disposal piping from Neutralization pit in DM plant area to Central monitoring basin in Effluent treatment plant area.
- 9) 800 meter Potable water piping from potable water pumps in DM plant area to potable water storage tank in TG area at 35.5 meter elevation.
- 10) Service water piping, instrument air piping, service air piping, etc. as applicable as per the Terminal Points.
- 11) In addition, any additional piping and associated accessories required to complete the system shall also be in bidder's scope.

4.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification and details indicated in Section C2 (Specific Technical Requirement Electrical) and D2 (General Technical Requirement Electrical).

5.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification and details indicated in Section C3 (Specific Technical Requirement C&I) and D3 (General Technical Requirement C&I).



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

6.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however complete grouting for equipment, fixing and any concreting inside the vessels and lining shall be in bidder's scope.

Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment 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

7.0 SCOPE OF SERVICES

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

- 1) Erection and Commissioning, unloading, storage and handling at site.
- 2) Arrangement of all instruments, reagents, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run & commissioning and Performance guarantee test.
- 3) Monitoring gadgets, instruments and equipments required for maintenance.
- 4) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
- 5) All personnel required during maintenance, Commissioning and Performance guarantee test.
- 6) Trial run for requisite period.
- 7) Performance guarantee test.
- 8) Painting shall be as specified in "Surface Preparation & Painting" Sec-D1 of this technical specification. Bidder to note that paint shed shall be finalized during detailed engineering as per customer & BHEL requirement and any variation in the painting schedule as finally approved by customer shall be taken care by bidder without any commercial and delivery implication.
- 9) Final touch up paint at site.

8.0 TERMINAL POINTS

- 1) 25 NB Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from the DM Plant area. However distribution and piping inside DM Plant area shall be in bidder's scope.
- 2) 25 NB Service air supply at 5 to 7 kg/cm² (g) - At 5 meter distance from DM Plant area. However distribution and piping inside DM Plant area shall be in bidder's scope.
- 3) Service water connection (50 NB connections) at 5 meter distance from DM Plant area. Piping inside DM Plant area for mentioned services will be in bidder's scope.
- 4) Drinking water (or potable water) of 25 NB connections - At 5 meter distance from the DM Plant area. However distribution and piping inside DM Plant area shall be in bidder's scope.
- 5) DM Water piping from DM plant upto nozzle flange of respective DM water storage tanks.
- 6) DM Water recirculation piping from DM water regeneration pumps upto nozzle flange of respective DM water storage tanks.
- 7) Potable Water piping from DM plant upto nozzle flange of potable water storage tanks.

9.0 EXCLUSIONS

- 1) All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. Also civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails, structural supports and hangers for pipes / cables / ducts, crane rails, all embedment's and inserts with



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in bidder's scope.

- 2) Instrument air & service air up to terminal points.
- 3) All chemicals.
- 4) Air conditioning, ventilation & fire fighting facilities.
- 5) Other exclusions are mentioned in the electrical & C&I parts of this specification.
- 6) Drinking water (or potable water), service water up to terminal points.
- 7) Regeneration effluents and other drains from equipments, vessels, tank etc shall be drained to N-pit through drain trenches. the required piping, valves fittings, instruments etc shall be in bidder's scope.

10.0 QP AND SUB VENDOR APPROVAL

- 1) The quality assurance plan is enclosed elsewhere in technical specification. 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.
- 2) The sub vendor list enclosed elsewhere in technical specification 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.

11.0 PERFORMANCE GUARANTEE TEST

The Performance guarantee test shall be as per Annexure-III/Section-C1.

12.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Section C & D the following shall also be complied under scope of this specification.

The P&ID for DM Plant (**Dwg.No.- PE-DG-410-163-A001**) is enclosed herein in this section for bidders compliance.

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 subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

13.0 DRAWING/DOCUMENTS REQUIREMENT

For the Drawings/Documents submission schedule, please refer **Vol-III**.

For the Drawings/Documents Submission Procedure, please refer **Sec-C1**. 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.



14.0 SPARES

1. 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.
2. The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding spares.
3. The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure VI. 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.

All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

4. Start-up and commissioning spares are in bidder's scope of supply.
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. 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 startup 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.

5. In addition to the spare parts mentioned above, the Bidder shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and unit prices in Price Schedules. This list shall take into consideration the mandatory spares specified Annexure VI and should be independent of the list of the mandatory spares. The BHEL reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. Price of recommended spares will not be used for evaluation of the bids. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by BHEL.

The vendor warrants:

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



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

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.

(iv) 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.

(v) 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.

6. The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.
7. 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.
8. 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.
9. It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

15.0 BIDDER to furnish 4 sets of techno-commercial bid including 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).
- Equipment layout. (Stamped & Signed).
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Electrical Load data in BHEL format (Stamped & Signed)
- Price Schedule duly filled in. (Stamped & Signed).
- List of Start-up & commissioning spares. (Stamped & Signed).
- List of Recommended spares. (Stamped & Signed).

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as **null & void**.

16.0 ADDITIONAL REQUIREMENT

1. Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating,



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

wrapping and protection required for buries pipes shall be in bidder's scope of work.

2. Wherever pipes are running on pipe rack ,Bidder will consider 15 m static head + 10% margin ,in addition to the losses in straight length and bend in pipes and valves etc. while selection of pump head during detailed engineering.
3. 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 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.
4. Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
5. 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.
6. Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
7. The Potable water chlorination plant shall be housed in the DM plant building. The space requirement for the same is 2.0 meters X 2.5 Meters X 4.0 meters (clear height). The control of the Potable water chlorination plant shall be done from DM plant PLC. The minim number of I/Os required for the Potable water chlorination plant is 50 numbers. Bidder to consider this in the DM plant and design the DM plant accordingly.
8. 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 switch gear /MCC on account of changed loads.
9. 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".
10. The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.
11. System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE , IBR , Weight & Measures Department and any other agency/ competent authority ,on behalf of the customer, related to installation of DM plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

12. Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.
13. Space available for D.M. plant (Vide ref. Dwg. No. PE-DG-410-163-A002) are attached in Section-C1 of this specification. Bidder to accommodate their equipment within the space provided.
14. 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.
15. Preparation of drawings / document / P&ID's in 3D modelling software and providing soft copy of same to BHEL.
16. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
17. Relevant requirements as per GTR, GCC, ECC & SCC.
18. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
19. Service water shall be available near DM plant/ system building/ area at approximately 1.5 to 2.0 Kg/ Cm2. Hence, bidder to take care for cooling/ lubrication of the pumps being supplied by the bidder under this technical specification. If service water pressure requirement is more than available pressure, bidder to consider two (2) nos. cooling pump for package.
20. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
21. Latest version of all codes and standards to be followed.
22. All the vertical pumps shall be considered as self-lubricating type unless specifically mentioned.
23. The depth of the water pits shall be considered as 3.0 meters (minimum) unless specifically mentioned.
24. Air distribution line to all final control elements like control valves, pneumatic dampers (both regulating / on-off type), SOV operated valves shall be through SS manifolds and SS isolating valves only. These valves shall be properly tagged also with KKS tag no. and description of final control element / instrument for which they are intended.
25. SITE VISIT BEFORE SUBMISSION OF OFFER.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

ANNEXURE – I
QUALITY ASSURANCE PLAN



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

Tests/Check	Material Test	WPS/PQR/Welder Qualification	DPT/MP1	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd.	Other Tests	Remarks
Items / Components											
1. Horizontal Centrifugal Pumps											
1.1. Casing	Y ^a		Y ^b				Y		Y		LEGENDS: Y Applicable
1.2. Impeller	Y ^a		Y ^b							Y ^d	Y ^a One per Heat/Heat Treatment batch./Lot
1.3. Shaft	Y ^a		Y						Y ^c		Y ^b On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds.
2. Vertical Pumps											Y ^c UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 20 mm or above.
2.1. Casing	Y ^a		Y ^b	Y	Y		Y		Y ¹		Y ^d Dynamic Balancing per ISO: 1940, Grade 6.3 minimum.
2.2. Impeller	Y ^a		Y ^b							Y ^d	Y ¹ As per HIS, USA.
2.3. Shaft	Y ^a		Y						Y ^c		Y ² 10% RT to be conducted on butt welds for Thk ≥10 mm.
2.4. Fabricated Parts	Y ^a	Y	Y ^b			Y ²	Y				Y ³ Seat Leakage Test for actuator operated valves shall be done by closing the valve with job actuator.
3. Dosing/ Metering Pumps	Y ^a						Y	Y ¹	Y		Y ⁴ Tests on Rubber Diaphragms per batch of Rubber mix such as Tensile, Elongation, Hardness, Thickness, Bleed Resistance, Flex Test for 1500 cycles etc. shall be conducted. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted, if not carried out earlier.
4. Gate/ Globe/ Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ^b	Y ⁵ Seat Leakage Test is required to be done in both directions. Disc strength test as per relevant code shall be carried out.
5. Dual Plate Check Valves	Y ^a		Y ^b		Y		Y ³	Y	Y	Y ¹²	Y ⁶ Blue Matching, Wear Travel for Gate Valves, reduced pressure test for check valves shall be conducted per relevant standards.
6 Diaphragm Valves	Y ^a				Y		Y ³	Y		Y ⁴	
6. Butterfly Valves (Low Pr.)				Y	Y					Y ⁵	
7.1Body (Cast)	Y ^a		Y ^b								
7.2Disc (Cast)	Y ^a		Y ^b								
7.3 Shaft	Y ^a		Y ^b								
8. Plug/ Ball Valves (Low Pr.)	Y ^a		Y ^b	Y	Y		Y	Y	Y	Y ^c	
9. Blowers	Y ^a		Y ^b	Y	Y		Y	Y	Y	Y ^{dc}	
10. Atmospheric Storage Tanks/ Pressure Vessels	Y ^a	Y	Y ^b	Y	Y	Y ³	Y		Y ^c	Y ¹	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

Tests/Check Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	Remarks
11. Rubber lining	Y ^a				Y				Y	Y ⁹	Y ⁷ Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall be stress relieved as per the requirement of code.
12. Resins / Activated Carbon Filter	Y ^a	Y	Y ^b	Y	Y				Y	Y ¹⁰	Y ⁸ RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.
13. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ³		Y	Y	Y ¹⁰	Y ⁹ Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.
14. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y	Y		Y ¹⁰ Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
15. Pipes	Y ^a	Y		Y	Y		Y	Y ¹¹	Y		Y ¹¹ One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.
16. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y				Y	Y ^{dc}	Y ¹² Blue Matching, reduced pressure test for check valves shall be conducted per relevant standards. Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.

After erection, the complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher.

Note:1) The above mentioned requirement are bare minimum. However any additional comments provided by BHEL / Customer shall be adhered by successful bidder without any commercial and delivery implication to BHEL/Customer.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

ANNEXURE-II

INDICATIVE SUB-VENDOR LIST



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

S NO.	ITEM	SUPPLIERS	PLACE
1.	ATMOSPHERIC TANK (CS/SS)	FABTECH	PUNE
		TECHNOFAB	NEW DELHI
		JASMINOT POLYMERTECH	PUNE
		PRESSURE VESSELS INDUSTRY	PUNE
		SPARKON ENGINEERING	
		BELCO POLLUTION CONTROL PVT LTD	GREATER NOIDA
2.	PRESSURE VESSEL	FABTECH	PUNE
		TECHNOFAB	NEW DELHI
		R&C	MUMBAI
		ISGEC	YAMUNANAGAR
		ANUP ENGG.	AHMEDABAD
3.	TANK /PIPING FABRICATION	FABTECH	PUNE
		TECHNOFAB	NEW DELHI
		BELCO POLLUTION CONTROL PVT LTD	GREATER NOIDA
		AQUATHERM	KOLKATA
4.	TANK (FRP)	INDUSTRIAL SERVICE	KOLKATA
		SUNRISE	BARODA
		GANDHI & ASSOCIATES	AHMEDABAD
		MODERN EQUIPMENTS	CHENNAI
		EAGLE PLAST	PUNE
		OMEGA PLAST	MUMBAI
5.	METERING PUMPS/PRV	MILTON ROY INDIA	CHENNAI
		VK PUMP	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD
6.	STROKE CONTROLLER	V K PUMPS	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD
		MILTON ROY INDIA	CHENNAI
7.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI
		KEYSTONE	BARODA
		V K PUMPS	NASIK
		MILTON ROY	CHENNAI
8.	AGITATOR/STIRRER	REMI	MUMBAI
		FIBRE & FIBRE PRODUTS	
		STANDARD ENGINEERS	MUMBAI
		CROMPTON GREAVES	AHAMADNAGAR
9.	STRAINER	OTOKLIN	MUMBAI
		GRAND PRIX	NEW DELHI
		JAYPEE	NEW DELHI



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		GREAVES COTTON	MUMBAI
		FILTRATION ENGINEERING	MUMBAI
		FLUID LINE VALVES	MUMBAI
10.	EJECTOR	ESSEMM TECHNOLOGIES	MUMBAI
11.	HORIZONTAL CENTRIFUGAL PUMP	BEST AND CROMPTON ENGG LTD.	CHENNAI
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD
		FLOWMORE LTD.	GURGAON
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE
		JYOTI LTD.	VADODARA
		KIRLOSKAR BROTHERS LTD	PUNE
		WILO MATHER & PLATT PUMPS PVT. LTD.	MUMBAI
		WPIL LIMITED	KOLKATA
12.	VERTICAL CENTRIFUGAL PUMPS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD
		FLOWMORE LTD.	GURGAON
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE
		JYOTI LTD.	VADODARA
		WILO MATHER & PLATT PUMPS PVT. LTD.	MUMBAI
		SULZER PUMPS INDIA LTD.	THANE
		WPIL LIMITED	KOLKATTA
13.	ORIFICE PLATE	MICRO PRECISION	FARIDABAD
		INSTRUMENTAION LTD	PALGHAT
		CARLO DYNAMICS	HYDRABAD
14.	BUTTERFLY VALVES	ADVANCE VALVES PVT. LTD.	NOIDA
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD
		INSTRUMENTATION LTD.	PALAKKAD-KERALA
		INTERVALVE (INDIA) LTD.	PUNE
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA
		VENUS PUMPS AND ENGG. WORKS	KOLKATA
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI
15.	CAST IRON GATE/GLV/NRV/SRV	A.V. VALVES LTD	AGRA
		ATAM VALVES PVT. LTD.	JALANDHAR
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH
		H.SARKER AND COMPANY	HOWRAH



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001
 VOLUME II-B
 SECTION –C1
 REV. NO. 00 DATE:

		LEADER VALVES LTD.	JALANDHAR
		VENUS PUMPS AND ENGG. WORKS	KOLKATA
16.	CONTROL VALVE	SPX CORPORATION, USA	USA
		CONTROL COMPONENT INC.	USA
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE
		DAUME REGELARMATUREN GMBH,	GERMANY
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI
		FORBES MARSHALL ARCA PVT.LTD.	PUNE
		WEIR VALVES & CONTROLS UK LTD.	UK
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY
		INSTRUMENTATION LTD.	PALAKKAD-KERALA
		KOSO INDIA PRIVATE LIMITED,	NASHIK
		LESLIE CONTROLS, INC	USA
		MIL CONTROLS LTD.	KERALA
		METSO SINGAPORE PTE. LTD.,	SINGAPORE
		PARCOL S.P.A	ITALY
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE
		RINGO VALVULAS S.L,	SPAIN
		SEVERN GLOCON INDIA PVT. LTD.	CHENNAI
		SHENJIANG VALVE CO. LTD.	CHINA
		VALVITALIA S.P.A. ,	ITALY
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY
17.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENAI
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI
		VENUS PUMPS AND ENGG. WORKS	KOLKATA
18.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA
		ATAM VALVES PVT. LTD.	JALANDHAR
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD
		M/S GM ENGINEERING	RAJKOT
		INTERVALVE (INDIA) LTD.	PUNE
		LEADER VALVES LTD.	JALANDHAR
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI
		NSSL LIMITED.	NAGPUR
		STEEL STRONG VALVES (I) PVT.LTD.	NAVI MUMBAI
		VENUS PUMPS AND ENGG. WORKS	KOLKATA
		VALTECH INDUSTRIES	MUMBAI
		V.K. VALVES PVT. LTD.,	JALANDHAR
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI
19.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		ALPHA SERVICES	NEW DELHI
		CONSOLIDATED HOISTS PVT LTD	PUNE
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD
		EDDY CRANES PVT. LTD.	MUMBAI
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD
		GLOBAL TECHNOLOGIES	HYDERABAD
		HERCULES HOISTS LTD.	RAIGAD
		LIFTING EQUIPMENTS AND ACCESSORIES	NEW DELHI
		MANGLA HOISTS PVT LTD	NEW DELHI
		REVA INDUSTRIES LTD.	FARIDABAD
		ROCKWELL HOISTO CRANES PVT. LTD.	JHAJJAR-HARYANA
		SAFEX ENERGY PVT. LTD.	AHMEDABAD
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA-
20.	DC LEAD ACID / NI-CD BATTERIES	AMCO SAFT INDIA LTD	BANGLORE
		EXIDE INDUSTRIES LTD	NEW DELHI
		HBL POWER SYSTEMS LTD	HYDERABAD
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY
21.	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	GOA
		INSTRUMENTATION LTD.	PALAKKAD-KERALA
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	GOA
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE
		SEIKO FLOW CONTROL GMBH	AUSTRIA
22.	FLOW ELEMENT - ORIFICE	FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD
		HYDROPNEUMATICS PVT. LTD.	GOA
		INSTRUMENTATION LTD.	PALAKKAD-KERALA
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD
		MINCO (INDIA) PRIVATE LIMITED	GOA
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE
23.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI
		COMFIT & VALVE PVT. LTD.	AHMEDABAD
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI
		FLUID CONTROLS PVT. LTD.	MUMBAI
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI
		PRECISION ENGINEERING INDUSTRIES	MUMBAI
		PANAM ENGINEERS,	MUMBAI
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI
		VIKAS INDUSTRIAL PRODUCTS	NOIDA
24.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI
		FLEXPRO ELECTRICALS PVT. LTD.	GUJARAT



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		K.S.INSTRUMENTS PVT.LTD.	BANGLORE
		SUCHITRA INDUSTRIES	BANGLORE
		SHRENIK & COMPANY,	GUJARAT
25.	LEVEL SWITCH- CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	GURGAON
		FLOWTECH INSTRUMENTS SERVICRS	VADODRA
		HI-TECH SYSTEMS & SERVICES LTD.	KOLKATA
		LEVCON INSTRUMENTS PVT. LTD.	KOLKATA
		RAMAN INSTRUMENTS PVT.LTD.	MUMBAI
		SIGMA INSTRUMENTS CO.	MUMBAI
		SOR INC.	USA
		SAPCON INSTRUMENT PVT LTD.	INDORE
		V. AUTOMAT & INTRUMENTS (P) LTD.	NEW DELHI
26.	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA
		ASHCROFT INDIA PVT LTD.	GUJARAT
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKATA
		FORBES MARSHALL (HYD) LTD.	HYDERABAD
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI
		H.GURU INDUSTRIES	KOLKATA
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI
27.	PROGRAMMABLE LOGIC CONTROLLER	GE INTELLIGENT PLATFORMS PRIVATE LIMITED	BANGALORE
		HONEYWELL AUTOMATION INDIA LIMITED	PUNE
		ROCKWELL AUTOMATION INDIA LTD	GHAZIABAD
		SIEMENS LIMITED	MUMBAI
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	NEW DELHI
28.	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	PUNE
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD
		FLOWTECH INSTRUMENTS SERVICRS	GUJARAT
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI
29.	SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	CHENNAI
		BLISS ANAND PVT. LTD.	GURGAON
		FLOWTECH INSTRUMENTS SERVICRS	GUJARAT
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD
		SIGMA INSTRUMENTS CO.	MUMBAI
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI
		TELACE EQUIPMENT PVT.LTD.	CHENNAI
30.	TEMPERATURE ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA
		DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	MUMBAI
		PYRO ELECTRIC INSTRUMENTS GOA	GOA



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		PVT.LTD.	
		TECHNO INSTRUMENTS	GUJARAT
		TEMPSENS INSTRUMENT (I) PVT LTD	UDAIPUR
		TM TECNOMATIC SPA	ITALY
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER
		THERMAL INSTRUMENT INDIA PVT. LTD.	MUMBAI
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI
31.	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA
		ASHCROFT INDIA PVT LTD.	GUJARAT
		BUDENBERG GUAGE CO.LTD.	UK
		FORBES MARSHALL (HYD) LTD.	HYDERABAD
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA
		GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	GOA
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI
		H.GURU INDUSTRIES	KOLKATA
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGLORE
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI
32.	TRANSMITTERS	ABB LIMITED	FARIDABAD
		ENDRESS + HAUSER (INDIA) PVT. LTD.,	NEW DELHI
		MOORE INDUSTRIES INTERNATIONAL INC.	USA
		NIVO CONTROLS PVT. LTD.	INDORE
		PUNE TECHTROL PVT. LTD.	PUNE
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	MUMBAI
		SIEMENS LIMITED	MUMBAI
		SMART INSTRUMENTS LTD, BRAZIL	MUMBAI
		SBEM PVT. LTD.	PUNE
		HONEYWELL AUTOMATION INDIA LIMITED	NEW DELHI
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER
		V. AUTOMAT & INSTRUMENTS (P) LTD.	NEW DELHI
		YOKOGAWA INDIA LIMITED,	BANGLORE
33.	BALL VALVE	BDK	HUBLI
		LEADER	JALANDHAR
		BANKIM	KOLKATA
		H SARKAR	KOLKATA
		AV VALVES	AGRA
		HAWA VALVES	MUMBAI
		FLOW CHEM	AHMEDABAD
		STEEL STRON VALVES	MUMBAI
		AKAY VALVES LTD.	MUMBAI
		AQUA VALVES PVT.LTD.	KARNATAKA
		CRESCENT VALVES	MUMBAI
		FISHER SANMAR LIMITED	CHENNAI
		HABONIM VAAS AUTOMATION PVT LTD.,CHENNAI	CHENNAI
		KIRLOSKAR BROTHERS LTD.	PUNE



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		KSB PUMPS LTD.	MUMBAI
		MICROFINISH VALVES PVT LTD.	HUBLI
		MICON VALVES (INDIA) PVT.LTD	MUMBAI
		PEC VALVES	MUMBAI
34.	SLUICE GATE	H SARKAR	KOLKATA
		JASH ENGINEERING	INDORE
		YASHWANT	MIRAJ
35.	DIAPHRAGM VALVE	PROCON ENGINEERES	MUMBAI
		HAWA VALVES	MUMBAI
		BDK VALVES	HUBLI
		FOURESS	BANALORE
		INERVALVE	GUJRAT
36.	3 WAY VALVE	HI TECH	AHMEDABAD
		ADVANCE VALVES PVT.LTD	NOIDA
		BDK	HUBLI
		FOURESS ENGG.INDIA LTD.	MUMBAI
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI
		INSTRUMENTATION LTD.	PALAKAD
		KIRLOSKAR BROTHERS LTD.	PUNE
		VENUS PUMP & ENGG. WORKS	KOLKATA
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI
		STAFFORD CONTROLS LIMITED	PUNE
		MICON VALVES (INDIA) PVT.LTD	MUMBAI
37.	PLUG VALVE	FISHER SANMAR LIMITED	CHENNAI
		BDK	HUBLI
		LARSEN & TOUBRO LTD.	MUMBAI
		LEADER	JALANDHAR
		MICON VALVES (INDIA) PVT.LTD	MUMBAI
38.	PIPING (SS/CS)	CHOKSHI TUBES	AHMEDABAD
		REMI	MUMBAI
		RATNAMANI	AHMEDABAD
		JINDAL STAINLESS	BAHADURGARH
		TISCO	JAMSEDPUR
		SAIL	
39.	FITTINGS (CS/SS)	BHARAT FORGE	PUNE
		RELIANCE FORGE	
		MS FITTINGS	KOLKATA
40.	FLANGES (SS/CS)	BHARAT FORGE	PUNE
		RELIANCE FORGE	
		MS FITTINGS	KOLKATA



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

41.	PIPE (CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI
		ASTROL PLYTECHINC LTD	AHMEDABAD
42.	VALVES (GATE/GLOBE/NRV/BALL)-CPVC	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI
		ASTROL PLYTECHINC LTD	AHMEDABAD
43.	RUBBER LINING FOR PIPES/TANKS	RISHI INDUSTRIES	SONEPET
		INDUSTRIAL LINING LTD	BARODA
		MIL	CHENNAI
44.	FILTER MEDIA	GLOBAL ABSORBENT	KOLKATA
		BHARAT MINERALS	
45.	LT MOTORS	CROMPTON GREAVES	AHMEDNAGAR
		LAXMI HYDRAULICS PVT. LTD	BANGALORE / HUBLI*
		RAJINDRA ELECT INDUSTRIES	FARIDABAD* / BANGALORE
		GE-POWER	
		BHARAT BIJLEE	MUMBAI
		SIEMENS	
		NGEF	
		KIRLOSKAR ELECTRIC CO LTD.	
		ASEA BROWN BOVERI	
		MARATHON	KOLKATA
46.	FUSES	INDO ASIAN	
47.	PUSH BUTTONS	BCH	
		CONTROL & SWITCHGEAR.	
		CANDS	
		L&T	
		SIEMENS	
		GEC	
48.	MCB	MDS SWITCHGEAR LTD.	
		INDO ASIAN	
		S&S	
		POWER SWITCHGEAR LTD	
49.	LEVEL GAUGE	LEVCON	KOLKATA
		SBEM	PUNE
		SIGMA	MUMBAI
		V. AUTOMAT	DELHI
		PUNE TECHTROL	PUNE
		CHEMTROLS	GOA
		DK INSTRUMENTS	KOLKATA
		SCIENTIFIC DEVICES	MUMBAI
50.	LEVEL TRANSMITTER (CAPACITANCE TYPE)	E&H	GERMANY
		LEVCON	KOLKATA



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		PUNE TECHTROL	PUNE
		MAGNETROL	BELGIUM
		NIVO CONTROL	INDORE
		WIKA	PUNE
51.	LEVEL TRANSMITTER (GUIDED WAVE RADAR)	K TECH	USA
		E&H	GERMANY
		EMERSON (SAB ROSEMOUNT)	SWEDEN
		MAGNETROL	BELGIUM
		EMERSON	DAMAN
		CHEMTROL	GOA
52.	LEVEL TRANSMITTER (ULTRASONIC TYPE)	SIEMENS MILLTRONICS	CANADA
		E&H	AURANGABAD
		KRISTLER MORSE	USA
		EMERSON	USA / PAWANE
53.	PRESSURE / DP / TEMP SWITCH	GAUGES BOURDON (I)	MUMBAI
		INDFOS	GHAZIABAD
		SWITZER	CHENNAI
		TREFAG	RANIPET
54.	SILICA ANALYSER	POLYTRON / HACH ULTRA	FRANCE
		ABB	UK
		HACH	USA
55.	SODIUM ANALYSER	POLYTRON / HACH ULTRA	FRANCE
		ABB	UK
		ORION	USA
		SWAN	USA / EUROPE
56.	ANALYSERS (PH/CONDUCTIVITY)	HACH (POLYMETRON)	SWITZERLAND
		ABB	UK / USA
		EMERSON	USA / PAWANE
57.	DENSITY INDICATOR	EUREKA	PUNE
		SCIENTIFIC DEVICES	THANE
58.	TEMPERATURE SWITCH	INDFOSS	GHAZIABAD
		DRESSER	USA
		SWITZER	CHENNAI
		SOR INC	USA
		TOSHNIWAL BRO	NEW DELHI
		VASU TECH	NEW DELHI
59.	FLOW TRANSMITTER	EMERSON	DAMAN
		TOKOGAWA	BANLORE
		HONEY WELL	
		ABB	FARIDABAD



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

60.	TURBIDITY METER	HACH	
		ABB	
		TOKOGAWA	
		ROSE MOUNT	
61.	LOCAL CONTROL PANEL	INDSUSTRIAL SWITCHGEAR & CONTROL	MUMBAI
		POSITRONICS	BARODA
		ECS	NOIDA
		SWITCHING CIRCUIT	KOLKATA
		CONTROL & SCHEMATICS	HYDRABAD
		GE POWER	BANGLORE
		SIEMENS	KOLKATA
		C&S	NOIDA
		PYROTECH	UDAIPUR
		DELTA CONTROL	MUMBAI
62.	PAINT	BERGER	
		ASIAN PAINTS	
		SHALIMAR	
		J&N	
63.	CABLE LUGS/FERRULES	M/S DOWELL	MUMBAI
		3D	UMBERGAON
		CHETNA	NASIK
64.	PVC CONDUIT	BIS LICENSEE/ISI MARKED WITH VALID CML NUMBER	
65.	CABLE GLAND	M/S SUNIL & CO	KOLKATA
		M/S ARUP ENGG	KOLKATA
		M/S COMET	MUMBAI
		M/S QUALITY PRECISION	KOLKATA
		M/S STANDARD METAL INDUSTRIES	MUMBAI
		M/S BRACO	MUMBAI
66.	SAFETY SHOWER	UNICARE	MUMBAI
67.	EIP CONVERTER OR I/P CONVERTOR	NORGREN(WATSON SMITH INSTRUMENTATION)	UK
		EMERSON	PAWANE
		ABB	FARIDABAD
68.	SOLENOID VALVE	ROTEX AUTOMATION	BARODA
		AVCON	MUMBAI
		ASCO	CHENNAI
69.	CABLE TRAYS & ACC.	EROS METAL WORKS (P) LTD.	NAGPUR
		INDUSTRIAL PERFORATION (I) PVT.LTD.	KOLKATA
		INDIANA GRATINGS PVT. LTD.	MUMBAI
		INDIA ELECTRICALS SYNDICATE	KOLKATA



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

	JAMNA METAL COMPANY	DELHI
	MAHESHWARI ELECTRICAL MFRS. PVT. LTD.,	NOIDA
	NAMDHARI INDUSTRIAL TRADERS PVT. LTD	LUDHIANA
	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	KOLKATA
	PATNY SYSTEMS (P) LTD	SECUNDRABAD
	PARMAR METALS PVT.LTD.	RAJKOT
	PASSIVE INFRA PROJECTS PVT. LTD.	NEW DELHI
	PENTAX FERRO INCORPORATE	MUMBAI
	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	KOLKATA
	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	KOLKATA
	RABI ENGINEERING WORKS PVT. LTD.	KOLKATA
	SARAL INDUSTRIES	RAE BARELI
	UNITECH FABRICATORS AND ENGINEERS PVT LTD	KOLKATA
	VINFAB ENGINEERS INDIA PVT. LTD.	MUMBAI

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.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

ANNEXURE – III
FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

PERFORMANCE GUARANTEES

1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

- a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.
- b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

- i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

OR

- ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

- i) Mechanical Completion
- ii) Preliminary Operation
- iii) Initial Operation
- iv) Reliability Operation
- v) Trial Operation
- vi) Performance Guarantee Tests

2.01.00 **Mechanical Completion**

- (a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

works.

- (b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:
- (i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.
 - (ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and
 - (iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00

Specific Requirements of Mechanical Completion

- (a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:
- (i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.
 - (ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.
- (b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- (i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.
- (ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.
- (iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.
- (iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.
- (v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.
- (vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.
- (vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.
- (viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

2.03.00

Other Prerequisites for Mechanical Completion

The Contractor shall also meet the following prerequisites for mechanical completion:

- (a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.
- (b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.
- (c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

- (d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.
- (e) All safety features and safety equipment are functional.
- (f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.
- (g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

2.04.00 Preliminary Operation

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

2.05.00 Initial Operation

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

2.06.00 Reliability Operation

- (a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

- (b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.
- (c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.
- (d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

- (e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.
- (f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- (g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.
- (h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

2.07.00

TRIAL OPERATION:

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.
2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.
3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.
5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.
6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

2.08.00

Performance Tests

- (a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trial operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

- (b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

- (c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/equipment' with the performance



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

guarantees.

- (d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.
- (e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.
- (f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.
- (g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.
- (h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.
- (i) It is Contractor's responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor's offer shall also be conducted.
- (j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.
- (k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.
- (l) **Reporting of Test Results**
 - (a) Within two weeks after the conclusion of the performance test,



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

- (b) The report(s) shall include as a minimum, the following:-
- (i) Scope
 - (ii) Various guaranteed parameters & tests as per the contract.
 - (iii) Codes/standards used
 - (iv) . Description of the test procedures
 - (v) Full schematic diagrams with indication of test instruments locations and identification tags of same.
 - (vi) Instrumentation details and calibration.
 - (vii) Duration of test, frequency of readings and number of test runs
 - (viii) Test logs and summary of test readings used for performance calculations.
 - (ix) Full set of correction curves.
 - (x) Computation of test results.
 - (xi) Sample calculation
 - (xii) Performance calculation
 - (xiii) Computations to prove measurement uncertainty is within acceptable limits.
 - (xiv) Acceptance criteria
 - (xv) Any other information required for conducting the test
 - (xvi) Conclusions of performance tests.
- (m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-
- (i) That Purchaser concurs with the information provided in the test report(s), or
 - (ii) That Purchaser disputes some or all of the information provided



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

- (n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.
- (o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

2.09.00 **Delayed Tests**

- (a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.
- (b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

(c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

(d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

(e) Disagreement as a Result of Tests

If the Purchaser and the Contractor disagree on the interpretation of the test results, each shall give a statement of his views to other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

3.00.00

SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES
[CATEGORY-A]

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.00	Plant		
3.01.01	Efficiency of steam generator	Efficiency of the steam generator at 100% & 80% TMCR while firing the Design coal at rated steam parameters, rated coal fineness and rated excess air. (Refer Note-1 for estimation of weightage factor.) Design coal shall be blended coal (50% imported coal + 50% indigenous coal).	As per Volume-I.
3.01.02	Steam generating capacity	Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.	As per Volume-I.
3.01.03	Turbine Cycle Heat rate	Turbine Cycle Heat rate in kcal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% & 80% of rated load (Refer Note-1 for estimation of weightage factor.)	As per Volume-I.
3.01.04	Output	Continuous output (MW) of 100% TMCR at Generator terminals under rated steam conditions at Turbine Inlet (247 kg/cm ² (a), 565°C, 593°C) and CW temperature of 33°C with 0% make-up with excitation power deducted	As per Volume-I.
3.01.05	Condenser Pressure	Condenser pressure in mm Hg (abs) under VWO conditions, 3% make up, design CW temperature and CW flow.	As per Volume-I.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.06	Total Auxiliary Power Consumption	The total auxiliary power consumption for all the auxiliaries of boiler, turbine Generator and turbine cycle equipments required for continuous unit operation at 100% and 80% of rated load under rated steam conditions and at design condenser pressure with 0% make-up. (Refer Note 1, 2, 3 & 4 for the basis of computation of Auxiliary power)	As per Volume-I.
3.01.07	Cooling Tower Cold Water Temperature	Cooling tower cold water at 100% TMCR under rated steam conditions and at design condenser pressure.	As per Volume-I.

Note :

- The weightage factor shall be estimated considering the following:
 - 80% rating for 2000 hrs in a year,
 - 100% rating for 6300 hrs in a year.
- For computation of Auxiliary Power, output measured at Generator terminals minus sent out power measured downstream of Generator Transformer, applicable Losses (No load loss + Load loss+ auxiliary loss for coolers) for Standby Transformers, Unit Transformers and Bus duct losses shall be considered.
- The equipment for auxiliary power consumption to be considered by the bidder shall include the equipment as per Annexure-C of Volume-I as minimum.
- Power consumption for Fire Pumps, Sump Pumps, Elevators, EOT Cranes shall not be considered in the Auxiliary Power consumption estimate.
- Heat Rate of TG Cycle : Maximum 1850 Kcal/kwh with Steam Turbine driven BFP.
- Steam Generator Efficiency : Not less than 85%
- Auxiliary Power Consumption shall be limited to 6% with Steam Turbine driven BFP and NDCT.
- Normal Availability of the Plant : 98% (2% forced outage)
- Plant Reliability : Minimum 95%
- The condenser pressure measurement while conducting the guarantee tests for CI Nos 3.01.03, 3.01.04 and 3.01.05 above shall be measured at 300 mm above the top row of condenser tubes.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

4.00.00 SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:

4.00.01 DM PLANT

Performance Guarantee parameters for Demineralization System

- a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.
- b) All blowers shall be guaranteed for head and power consumption.
- c) Activated Carbon Filter
 - (i) Each Activated Carbon Filter will have a rated continuous treated water output capacity of not less than 60 m³/hr (net) over and above the quantity of treated water required for backwash / regeneration / rinse of itself and other units of the same stream or chain it belongs to. It shall be backwashed once after every 18 hours of continuous service run.
 - (ii) Free chlorine content of treated water shall be nil.
- d) Ion Exchange Units
 - (i) Each Ion Exchange Unit will have a rated continuous treated water output capacity of not less than 60 m³/hr (net) over and above the quantity of treated water required for backwash / regeneration / rinse of itself and other units of the same stream or chain it belongs to. Except Mixed Bed Units, each Ion Exchange Unit shall be regenerated once after every 18 hours of continuous service run. Each Mixed Bed Unit shall be regenerated once after every 126 hours of continuous service run.
 - (ii) Net output from each of Weakly Acidic Cation Exchanger Unit, Strongly Acidic Cation Exchanger Unit, Weakly Basic Anion Exchanger Unit, Strongly Basic Anion Exchanger Unit between two regeneration shall be not less than 1080 m³ of treated water and that for each of Mixed Bed Exchanger Unit shall be not less than 7560 m³ of treated water for the design water analysis as exhibited elsewhere in technical specification. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this Specification and guarantee shall be applicable on this calculated quantity.
 - (iii) Chemical consumption of the ion exchange units as indicated by the Bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance. The guaranteed values of chemical consumption shall hold good for chemicals conforming to following specification :
 - a. Hydrochloric Acid IS-265 (Tech Grade)
 - b. Sodium Hydroxide IS-252 (Rayon grade available in Flakes)
 - (iv) The total time for backwash (as applicable) and regeneration of a stream of Demineralization System Stream (for Activated Carbon Filter - Weakly Acidic Cation Exchanger – Strongly Acidic Cation Exchanger - Weakly Basic Anion Exchanger - Strongly Basic Anion Exchanger) except the Mixed Bed Exchanger shall not exceed 4 hours.
 - (v) The total time for complete backwash (as applicable) and regeneration of a stream of Demineralization System Stream and (for Activated Carbon Filter - Weakly Acidic Cation Exchanger - Strongly Acidic Cation Exchanger - Weakly Basic Anion Exchanger - Strongly Basic Anion Exchanger – Mixed Bed Exchanger) shall not exceed 6 hours.
 - (vi) Qualities of treated water from various units are envisaged as follows:

Water Quality at the outlet of MB Exchanger:

- Total Electrolyte 0.1 ppm, max.
- Total SiO₂ 0.01 ppm SiO₂, max.
- Iron as Fe Nil
- Free CARBON DI-OXIDE ppm as CARBON DI-OXIDE Nil



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- Total Hardness Nil
- pH value at 25°C 6.8 - 7.2
- Conductivity, micro mho/cm < 0.1 at 25 °C

Water Quality at the outlet of Strongly Basic Anion Exchanger:

- SiO₂ <0.1 ppm as SiO₂
- Conductivity, micro mho/cm < 5.0 at 25 °C

Water Quality at the outlet of Degasser Tower:

- CARBON DI-OXIDE content < 5 ppm as Carbon Di-Oxide.

Water Quality at the outlet of Strongly Acidic Cation Exchanger:

- Sodium <1.0 ppm as CaCO₃
- Hardness Not Detectable



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

ANNEXURE IV

DRAWING DOCUMENTS DISTRIBUTION SCHEDULE



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

S no.	Description	TSGENCO								DCPL, KOLKATA			Equipment Vendor	PEM	BHEL site
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/TPC-I, Hyd	CE/O&M/KTPS	SE/Civil KTPS	SE/E&M/KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS			
A	Letter Of Intent or Contract Documents	1	1	1	S	1	2	2	1	1	1	1	2	1	1
B	Vendor Drawings														
1	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	4+S	-
2	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	4+S	-
3	Final and any revision thereof														
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	4+S	-
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	4+S	-
C.	Design Drawings														
1	Preliminary														
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	4+S	-
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	4+S	-
2	Released for construction														
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	1+S	4+S
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	1+S	4+S
3	Return marked 'As built'														
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	1+S	4+S
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	1+S	4+S
4	As built drawings														
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	1+S	4+S
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	1+S	4+S
D	Progress Report Monthly														
1	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	S	1+S
2	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	-	-
E	Test & Inspection Reports														
1	Equipment manufacturer														
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	S	S
	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	S	S
2	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	S	S
F	Instruction Manuals/Data Books														
1	Equipment manufacturer														
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	1+S	4+S
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	1+S	4+S
2	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil		
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	1+S	4+S
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	1+S	4+S
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	S	1+S

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

Note: Editable EXcell, Word and Autocad copy of applicable document shall be submitted by bidder/vendor whenever required by BHEL/ Customer for review.

Note:

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



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy / MS-word (as applicable)/MS-Excel (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - P&IDs.
 - Equipment lay out.
 - Equipment Cable tray layout.
 - Civil scope drawings.
 - Piping lay out drawing.
 - Valve schedule.
 - Instrument schedule.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

ANNEXURE-V
PAINTING SPECIFICATION



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- 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.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- 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.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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**



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- 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 :
- Surface preparation shall be done either manually or by any other approved method.
 - Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - 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 :
- Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - 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.
 - 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 :



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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

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

- a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
- b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
- c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

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

- a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
- b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
- c) Total thickness of primer and paint should not be less than 500 microns.

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

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

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



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

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

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

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :
 The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- 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



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
 The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

$$\text{Testing Voltage } V = 7900 \sqrt{T} \pm 10 \text{ percent where } T \text{ is the average coating thickness in mm.}$$
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 **Adhesion Pull off Test :**
 After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.
- 6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:
 A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.
- 6.03.02 Prepare the test surface :
 Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.
- 6.03.03 Prepare Dolly (Test Pull Stub) :



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

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.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

ANNEXURE-VI

MANDATORY SPARES LIST



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

LIST OF MANDATORY SPARES (AS APPLICABLE)

Sl. No.	Equipment/Package Name	Quantity	Remarks
1.0	Spares for Horizontal Centrifugal Pumps		
1.1	Shaft	1 No.	
1.2	Shaft Sleeve	2 Nos.	
1.3	Impeller	1 No.	
1.4	Impeller locking nut and bolt	4 Nos.	
1.5	Impeller wear ring	4 Nos.	
1.6	Casing wear ring	4 Nos.	
1.7	Oil Seal	4 Nos.	
1.8	Oil Deflector	3 Nos.	
1.9	Oil Ring	3 Nos.	
1.1	Gland Packing	4	
1.11	Lantern Ring	3 Nos.	
1.12	Mech Seal Assembly	1 No.	
1.13	Stationary/Carbon Packing and O" Ring for Mechanical Seal"	3 Sets	
1.14	Oil Level Gauge	3 Nos.	
1.15	Coupling	2 Nos.	
1.16	Rubber Bush for Coupling	2 Nos.	
1.17	O" Rings "	2 Sets	
1.18	Suction Strainers Element	3 Nos.	
1.19	Bearing for Pump Motor	2 Sets	
2.0	Spares for Vertical Type Centrifugal Pumps (at Neutralising Pit)		
2.1	Complete Bowl assembly	1 Set	
2.2	Impeller (s)	1 Set	
2.3	Shafts	1 Set	
2.4	Casing wearing (s)	1 Set	
2.5	Impeller wear ring (s)	1 Set	
2.6	Shaft Sleeves	2 Sets	
2.7	Shaft Couplings	1 Set	
2.8	Shaft nuts & keys	1 Set	
2.9	Lantern rings	1 Set	
2.10	Bell mouth liner	1 Set	
2.11	Bearings	1 Set	
2.12	Pump motor coupling	1 Set	
3.0	Spares for Agitators		
3.1	Gear Box Unit Complete	1 No.	
3.2	Bearing for Gear Box Unit	1 Set	
3.3	Coupling complete (Motor/Gearbox and gearbox/agitator)	1 Set	
3.4	Coupling Bolts	1 Set	
3.5	Coupling shim pack (if applicable)	4 Sets	
3.6	Oil seals	4 Sets	
4.0	Spares for Valves		
4.1	i) Manual Diaphragm valves	10% of total quantity used for each type and size with minimum no. two(2) for each type and size.	
	ii) Auto Diaphragm valves	10% of total quantity used for each type and size with minimum no. two(2) for each type and size.	
	iii) Spare Diaphragm for above	10% of total quantity used for each type	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

		and size with minimum no. two(2) for each type and size.	
	iv) Diaphragm	10% of total quantity used for each type and size with minimum no. two(2) for each type and size.	
4.2	i) Non return valves (NRV)	2 nos. of each size & type	
	ii) Flaps for above NRV	2 nos. of each size	
4.3	Gate/Globe/Ball valves/plug valve/needle valve		
	i) Upto 4"	10% of total quantity used for each type and size with minimum no. two(2) for each type and size.	
	ii) Above 4"	1 no. each type and size.	
4.4	Butter fly valve		
	i) Upto 4"	10% of total quantity used for each type and size with minimum no. two(2) for each type and size.	
	ii) Above 4"	1 no. each type and size	
5.0	Spares for Filter Media/ ION Exchange Resins		
5.1	Media for Dual Media Pressure Filters	10% of total quantity	
5.2	Media for Activated Carbon Filters	10% of total quantity	
5.3	Resins for each type of exchangers	10% of total quantity	
5.4	Packings for Degasser Towers	10% of total quantity	
5.5	Ejectors	Two(2)nos.ofeachtypeincludingchlorination application.	
6.0	Spares for Air Blowers		
6.1	Impeller with shaft	1 Set	
6.2	Bearings	1 Set	
6.3	Oil seals	5 Sets	
6.4	Filter	1 Set	
7.0	Pneumatic Control Valve		
7.1	Pneumatic Diaphragm for Diaphragm actuated valve	2 Nos. for each type of Actuator	
7.2	Gland Packing	1 set for each type of Control Valve	
7.3	Plug, Seat, Cage, Stem etc.	1 set for each type of Control Valve	
7.4	Retainer Ring, Seal Ring etc.	1 set for each type of Control Valve	
7.5	Gasket	2 Sets. for each type of Control Valve	
7.6	Position Transmitter complete set	10% of total quantity used in the system for each type and model.	
7.7	Control Valve E/P Positioner complete Set	10% of total quantity used in the system for each type and model.	
7.8	Complete Set of Solenoid Valve for Pneumatic type On/Off Valve	2 Nos. for each type & ratings	
7.9	Solenoid Coil for Pneumatic type On/Off Valve	5 Nos. for each type & ratings	
7.10	Position Limit Switch for Pneumatic type On/Off Valve	10 Nos. for each type & ratings	
8.0	Electrical Items		
8.1	415 Volt Motor (above 30KW Rating upto 200KW)		
8.1.1	End Shield Cover Driving & Non-Driving End	1Set for each type and rating of Motor	
8.1.2	Driving End & Non-Driving End Bearing	1Set for each type and rating of Motor	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

8.1.3	Cooling Fan	1No. for each type and rating of Motor	
8.1.4	Motor Space Heater	1No. for each type and rating of Motor	
8.1.5	Motor Terminal Block	1No. for each type and rating of Motor	
8.1.6	Complete Set of Coupling	1Set for each Application	
8.2	415 Volt Motor (Upto 30KW Rating)		
8.2.1	Driving End & Non-Driving End Bearing	3Set for each type and rating of Motor	
8.2.2	Cooling Fan	2No. for each type and rating of Motor	
8.2.3	Motor Terminal Block	5No. for each type and rating of Motor	
8.2.4	Complete Set of Coupling	1Set for each Application	
9.0	C&I Items		
9.1	PLC/ Proprietary Control System		
9.1.1	Network cards, Communication Interface cards	5% for each type or but minimum 1 no.	
9.1.2	I/O Cards (Each type)	5% for each type but minimum 1 nos.	
9.1.3	Controller Cards	2 nos.	
9.1.4	SER Cards	5% for each type or but minimum 1 no.	
9.1.5	All other Electronic Modules	5% for each type but minimum 1 no.	
9.1.6	Relays	10% of total quantity	
9.1.7	Power Supply Modules & Power Packs for control system	5% for each type and range but minimum 1 no.	
9.1.8	Network Items (Network switch/ LIU unit/ Transceiver/ FO patch cord etc.)	10% for each type or but minimum 1 no.	
9.1.9	MCB (Miniature case circuit breaker)	10% for each type or but minimum 1 no.	
9.1.10	Fuses	200% each type and rating	
9.1.11	Racks for housing I/O & Processor Modules	1(One) no. each type used in the system	
9.1.12	Prefab interconnecting cables with connectors	10% of total nos. used in the system or minimum 4(four) nos. whichever is more for each type.	
9.1.13	Network communication cable with end connectors	10% but minimum 1	
9.1.14	I/O bus cables with connectors for remote I/O units	1 no. of each type & length	
9.1.15	Fibre optic cable Converter / Deconverter	1 no.	
9.1.16	Cooling Fans	10% but minimum 1	
9.1.17	Loose Connectors	5 nos. of each type	
9.1.18	Colour TFT Monitor	1 no. complete set	
9.1.19	Hard Disk Drive for the work Station	1 no. complete set	
9.1.20	Key board , mouse / trackball with connecting cables and plugs	1 no. each type.	
9.1.21	Printers Cartridges	2 nos. of each type	
9.1.22	SMPS for printers	1 no. of each type/ rating	
9.1.23	SVGA cards for printers	1 no. of each type	
9.1.24	Key Board & Cursor control device	1 no. of each type	
9.1.25	Complete Set of Operators Work Station	1no. complete set	
9.1.26	Terminal Block	10% of total nos. used in the system for each type and rating.	
9.1.27	Read-Write CD/DVD	10% but minimum 1	
9.1.28	Blank CD/DVD	50 (fifty) nos.	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

DATA SHEET-A FOR DM PLANT

1.00.00	DM FEED PUMPS	
A)	Number	Three (3) (2Working +1Standby)
B)	Description for each Pump	
(i)	Location	Clarified water pump sump. Depth of clear water sump is 4.5 meters.
(ii)	Fluid to be handled	Clarified Water
(iii)	Service	To transfer clarified Water to Dual media pressure filters.
(iv)	Duty	Continuous and to be suitable for parallel operation.
(v)	Type of Pump	Vertical Centrifugal Non clog type
(vi)	Type of Impeller	Open/ semi open
(vii)	Location	Outdoor
(viii)	Design temperature, in degree Celsius	60
(ix)	Design Standard	As per technical specification
(x)	Rated Capacity, in m3/hr of each pump	Not less than 85 m3/hr
(xi)	Suction condition	Flooded
(xii)	Minimum Head to be developed at rated capacity MLC	To be specified by the Bidder considering 10% margin to meet the requirements of the system as per Bid Specification. (C should be considered as 120 to calculate frictional loss in pipe as per Hagen Williams Equation).
(xiii)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xiv)	Range of operation	20 % - 120 %.
(xv)	Pump speed	1500 RPM (maximum)
(xvi)	Material of construction	
	• Casing	Ni hard C.I. as per ASTM 532.
	• Shaft	EN-8 as per BS-970.
	• Impeller	Ni hard C.I. as per ASTM 532.
	• Common Base plate	Fabricated Steel as per IS 2062.
	• Nuts and bolts	SS-316 (under wetted condition) and MS Cadmium plated (in other places)
(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive	Minimum 15 % margin over BKW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ ($+3$ to -5%).
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Painting for complete set of Pump & Motor	
	• Primer	As per the requirements of Painting Specification.
	• Finish paint	As per the requirements of Painting Specification.
	• Shade	As approved by BHEL.
(xxiv)	Tests and Inspection	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xxv)	Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	a) Hydro-test	As per IS-1520 and IS-5120.
	b) Dynamic Balancing Test	Shall be provided by the Bidder
	c) Performance Test	Required
(xxvi)	Instruments along with alarms, interlocks and accessories	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxvii)	Start and stop facility provided both at local and remote	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxviii)	Trip interlock	Shall be provided by the Bidder.
2.00.00	DUAL MEDIA PRESSURE FILTERS	
A)	Number	Three (3) [Two (2) number is working and one (1) number is standby].
B)	Description for unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor
(iii)	Design Rated Service Flow Rate (Net) in m3/hr	Not less than 75
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m3	Not less than 1350
(vi)	Design surface flow rate in m3/m2/hr	Not more than 10
(vii)	Design Temperature in degree Celsius	60
(viii)	Design Pressure in kg/cm2 (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Suspended solids, in ppm	15
(x)	Design Outlet Suspended solids, in ppm	Not more than 2.0
(xi)	Design Code	IS 2825/ASME Sec. VIII Div. 2010
(xii)	Code for Tests and Inspections	Shall be hydraulically tested at 1.5 times of design pressure or 2 times of the working pressure, whichever is higher, for a period not less than one (1) hour.
(xiii)	Filter Media	
	a) Type	Bed of Graded Sand and Anthracite supported over Graded Gravel.
	b) Characteristics of Anthracite	Grade: To be indicated by the Bidder. Bulk Density: 900 kg/m3. Uniformity Coefficient: 1.7. Ash (minimum): Less than 30 %.
	c) Characteristics of Sand	Grade: To be indicated by the Bidder. Bulk Density: 1400-1600 kg/m3. Acid Solubility: Not to exceed 5% [10% HCl & 24 hrs]. Effective size, mm : Around 0.45. Uniformity Coefficient: 1.6-1.65. Silica : 90 %. (minimum)
	d) Bed depth in mm	Anthracite - minimum 350 and Sand -minimum 750.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	e) Percentage freeboard	75 % minimum.
(xiv)	Details of Regeneration of Filter Media	
	a) Air Scour	Air Scour by air from Air Blowers for Dual Media Pressure Filters.
	b) Air Scour Velocity	40 Nm ³ /hr/m ² (minimum) of filtration area at a suitable head.
	c) Backwash	Backwash by reversible flow of filtered water.
	d) Backwash Velocity	As per supplier design specific to meet the system requirements.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
	a) Internal	
	• Material	Two (2) coats of solvent less epoxy primer with polyamide hardener followed by three (3) coats (minimum) of solvent less hi-build epoxy finished coat with approved hardener and final painting with two (2) coats of synthetic enamel paint.
	• Thickness	Not less than 500 microns DFT.
	b) External	As per Painting schedule
(xvii)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xviii)	Sight windows	One (1) number in Backwash Space.
(xix)	Hand hole	One (1) number of 150 mm dia. for removal of media inside.
(xx)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxi)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
3.00.00	AIR BLOWERS FOR DUAL MEDIA PRESSURE FILTERS	
A)	Number	Two (2) (1Working +1Standby)
B)	Description for each Blower	
(i)	Location	Indoor
(ii)	Fluid to be handled	Ambient Air.
(iii)	Service	To scour the filter bed prior to backwash.
(iv)	Duty	Intermittent.
(v)	Type of Blower	Rotary Twin Lobe Oil Free.
(vi)	Type of Impeller	Involutes.
(vii)	Design standard	As per Bid Specification.
(viii)	Service temperature in degree Celsius	60
(ix)	Rated Capacity, (each) in m ³ /hr	100% requirement of each Bed of Dual media Filter
(x)	Permissible tolerance in rated capacity, in %	As per BS-1571-Part II.
(xi)	Head to be developed at rated capacity	Bidder to indicate, to ensure the desired performance.
(xii)	Material of construction	
	a) Casing	CI
	b) Lobe	CI
	c) Common Base plate	Fabricated Steel
	d) Coupling Pulley	C.I./Carbon Steel



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	e) Coupling Guard	Carbon Steel
	f) Safety Relief Valve	SS-316
	g) Nuts and bolts	Carbon Steel
(xiii)	Type of drive	Electrical Motor
(xiv)	Criteria for selection of drive	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the blower.
(xv)	Rated speed (RPM)	1500 (Sync.) maximum.
(xvi)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V (+10%), 3 Phase, 50 (+5%), HZ
(xvii)	Type of coupling between Blower & Motor	V Belt.
(xviii)	Noise level (for complete set of Blower & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
(xix)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller and Shaft.
	b) Hydro-test	BS-1571-Part II.
	c) Dynamic Balancing Test	Shall be provided by the Bidder
(xx)	Performance Test	
	a) Test Code	BS-1571-Part II.
	b) Tests to be done for determination of	Head-Capacity Curve and BHP-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of Blower at site	Required.
(xxi)	Instruments and alarm	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder.
(xxiii)	Accessories Shall be provided by the Bidder	Common base frame, Pulley, Acoustic hood, V-Belt Guard, Suction Filter, Suction Silencer, Discharge Silencer, Anti Vibration Pad, Safety Relief Valve, Non Return Valve
4.00.00	OVERHEAD FILTER BACKWASH WATER STORAGE TANK	
A)	Numbers	One (1) number
B)	Description	
(i)	Type	Rectangular and Overhead
(ii)	Type of fluid to be handled	Filtered Water.
(iii)	Material of Construction	RCC with acrylic reinforced cementitious flexible water proof coating conforming to BS 1881 Pt 5 1983 DIN-1048 Water penetration test.
(iv)	Effective Capacity (each compartment)	Suitable to hold the filtered water required for single backwash of one (1) number Dual media Filter plus 20% margin or 50 m ³ whichever is higher + 50 M ³ capacity of Potable water.
(v)	Minimum Free Board, in mm	500
(vi)	Design Temperature in degree Celsius	60
5.00.00	FILTER BACKWASH SUMP	
A)	Numbers	One (1) no. in two compartments
B)	Description	
(i)	Type	Rectangular and flat bottom.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(ii)	Type of fluid to be handled	Backwash waste of Dual Media Filters
(iii)	Effective capacity of each compartment m ³	Suitable to hold backwash waste generated from single backwash of one (1) number Dual Media Filter in a day plus 20% margin or 50 m ³ whichever is higher.
(iv)	Minimum Free Board, in mm.	500
(v)	Material of Construction	RCC.
(vi)	Type of Protection	
	a) Internal	Epoxy painted as per relevant sub section.
(vii)	Sludge Flushing Arrangement	Required through high pressure water and nozzles to ensure no deposition / settling of sludge as per the Bid P&ID Water shall be taken from service water pump discharge header. Booster Pump if required, for producing high pressure water, shall be in Bidder's scope.
(viii)	Accessories	Shall be provided by the Bidder as per P&ID and bid specification, enclosed with the Specification.
(ix)	Instruments	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
6.00.00	BACKWASH WASTE WATER DISPOSAL PUMPS	
A)	Number	Two (2) [One (1) number to be under operation and the other as standby].
B)	Description for each Pump	
(i)	Type	Vertical, Centrifugal Non Clog type
(ii)	Type of Impeller	Open/ semi open
(iii)	Location	Outdoor
(iv)	Fluid to be handled	Backwash water
(v)	Duty	Intermittent, suitable for parallel operation
(vi)	Design Standard	As per Bid Specification
(vii)	Design Temperature, degree Celsius	60
(viii)	Rated Capacity m ³ /hr	Not less than 25 m ³ /hr
(ix)	Suction Condition	Flooded.
(x)	Minimum Head to be developed at rated capacity, MLC	To be specified by the Bidder considering 10% margin to meet the requirements of the system as per Bid Specification. (C should be considered as 120 to calculate frictional loss in pipe as per Hagen Williams Equation).
(xi)	Shut off Head	To be suitable for stable operation at rated duty point.
(xii)	Range of operation	20% - 120%
(xiii)	Pump speed (RPM)	1500 maximum.
(xiv)	Material of construction	
	• Casing	Ni hard C.I. as per ASTM 532.
	• Shaft	EN-8 as per BS-970.
	• Impeller	Ni hard C.I. as per ASTM 532.
	• Nuts and Bolts	SS-316 (under wetted condition) and MS Cadmium plated (in other places)
(xv)	Type of drive	Electrical Motor
(xvi)	Criteria for selection of drive	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xvii)	Rated speed (RPM)	1500 (Sync.) maximum.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xviii)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ (+3 to -5%).
(xix)	Type of coupling between Pump & Motor	Flexible Spacer.
(xx)	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).
(xxi)	Painting for complete set of Pump & Motor	
	• Primer	As per the requirements of Painting Specification.
	• Finish paint	As per the requirements of Painting Specification.
	• Shade	As approved by BHEL.
(xxii)	Tests and Inspection	
	• Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	a) Hydro-test	As per IS-1520 and IS-5120.
	b) Dynamic Balancing Test	Shall be provided by the Bidder
	c) Performance Test	Required
(xxiii)	Instruments along with alarms, interlocks and accessories	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxiv)	Start and stop facility provided both at local and remote	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxv)	Trip interlock	Shall be provided by the Bidder.
7.00.00	ACTIVATED CARBON FILTERS	
A)	Number	Two (2) [One (1) number is working and one (1) number is standby].
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Design Rated Service Flow Rate (Net) in m ³ /hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m ³	Not less than 1080
(vi)	Design surface flow rate in m ³ /m ² /hr	Not more than 15.
(vii)	Design Temperature in degree Celsius	60
(viii)	Design Pressure in kg/cm ² (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the Design Clarified Water Analysis
(x)	Design Treated Water Quality	As indicated elsewhere in the Specification
(xi)	Design Code	ASME SEC-VIII – DIV-I/ IS-2825.
(xii)	Code for Tests and Inspections	Shall be hydraulically tested at 1.5 times of Design Pressure or 2 times of the Working Pressure, whichever is higher, for a period not less than one (1) hour.
(xiii)	Filter Media	
	a) Type	Activated Carbon.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	b) Characteristics of Activated Carbon	Grade: De Chlorination Grade. Bulk Density: Not less than 400 kg/m ³ . Particle Density wetted in water: 1.3-1.4 gm/cc. Effective size, mm: 0.8-0.9 mm. Uniformity Coefficient: 1.5-1.6. Mean particle dia: 1.2-1.4 mm. Total surface area: Not less than 850 m ² /gm. Iodine number : Minimum 900. Carbon content: Not less than 90%. Moisture content: 5% (max). Ash content: 8% (max).
	c) Bed depth in mm	Activated Carbon -minimum 1200 and Support Gravel - minimum 450.
	d) Percentage freeboard	100% minimum.
(xiv)	Details of Regeneration of Filter Media	
	a) Backwash	Backwash by reversible flow of filtered water.
	b) Backwash Velocity	To be specified by the Bidder.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
	a) Internal	
	• Material	Two (2) coats of solventless epoxy primer with polyamide hardener followed by three (3) coats (minimum) of solventless hi-build epoxy finished coat with approved hardener and final painting with two (2) coats of synthetic enamel paint.
	• Thickness	Not less than 500 micron DFT.
	b) External	As per attached painting schedule
(xvii)	Cleats for internal support	MOC-SS-316
(xviii)	Carbon Traps	Two (2) numbers for each vessel, One (1) at service water outlet and one (1) at backwash outlet.
(xix)	Under Drain System	
	a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	b) Material of Construction	For Header Lateral, Header: MSEP & Lateral: PP/PVC (double decker replacable type) For Strainer on plate, Plate: MSEP and Strainer: PP/PVC (double decker replacable type).
	c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidderto give access below the bed plate.
(xx)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia. (for each vessel).
(xxi)	Sight windows	One (1) number in Backwash Space.
(xxii)	Hand hole	One (1) number of 150 mm dia. for removal of Activated Carbon.
(xxiii)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
8.00.00	WEAKLY ACIDIC CATION EXCHANGERS	
A)	Number	Two (2) [One (1) number is working and one (1) number is standby].
B)	Description for each unit	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Design Rated Service Flow Rate (Net) in m ³ /hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m ³	Not less than 1080 (Based on 10 % deration on exchange capacity of the resin).
(vi)	Design surface flow rate in m ³ /m ² /hr	Not more than 40.
(vii)	Design Temperature in degree Celsius	60 (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in the Specification.
(viii)	Design Pressure in kg/cm ² (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the stipulations of Tender Specification.
(x)	Design Treated Water Quality	As per the stipulations of Tender Specification.
(xi)	Design Code	ASME SEC-VIII-DIV-I / IS-2825
(xii)	Code for Tests and Inspections	Shall be hydraulically tested at 1.5 times of Design Pressure or 2 times of the Working Pressure, whichever is higher, for a period not less than one (1) hour.
(xiii)	Ion Exchange Resins	
	a) Type	Cross linked polyacrylic matrix with carboxylic acid as functional group (gel type with particle size 0.3 to 1.2 mm)
	b) Bed depth in mm	Effective Bed Depth: Minimum 1000.
	c) Percentage freeboard	100 % minimum.
(xiv)	Details of Regeneration of Ion Exchange Resins	
	a) Regenerant	Thorough fare by Hydrochloric Acid
	b) Regeneration mode	Co Current.
	c) Injection	By hard ebonite lined Ejector. One (1) number Density Indicator shall be provided by the Bidder at outlet of the Ejector.
	d) Accessories	Each ejector shall be provided by the Bidder with flow indicator on Power Water supply line as well as flow indicator cum transmitter on discharge line.
	f) Regeneration Level	Should be optimum and suitable to prevent leakage of ions.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached paintings schedule
(xvii)	Resin Traps	Two (2) numbers for each vessel one (1) at service outlet and other at backwash & rinse outlet.
(xviii)	Regenerant Distributor	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Material of Construction	MSRL-RC/Hastalloy-C
(xix)	Interface Collector	
	a) Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with pp strainers (double decker replaceable type)
	b) Location	150 mm below the top of total Resin bed i.e. at the interface of inert & effective resin bed.
(xx)	Cleats for Internal Support	SS-316
(xxi)	Under Drain System	
	(a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	(b) Material of Construction	For Header Lateral, Header: MSRL-RC and Lateral: PP/PVC (double decker replacable type) For Strainer on plate, Plate:MSRL & Strainer :PP/PVC (double decker replacable type).
	(c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidder to give access below the bed plate.
(xxii)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xxiii)	Sight windows	Two (2) numbers One at resin top level and other at backwash space.
(xxiv)	Hand hole	One (1) number of 150 mm dia. for removal of Ion Exchange Resins.
(xxv)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxvi)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
9.00.00	STRONGLY ACIDIC CATION EXCHANGERS	
A)	Number	Two (2) [one (1) number is working and one (1) number is standby].
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Design Rated Service Flow Rate (Net) in m3/hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m3	Not less than 1080 (Based on 10 % deration on exchange capacity of the resin).
(vi)	Design surface flow rate in m3/m2/hr	Not more than 40.
(vii)	Design Temperature in degree Celsius	60 (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in the Specification.
(viii)	Design Pressure in kg/cm2 (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the stipulations of Tender Specification.
(x)	Design Treated Water Quality	As per the stipulations of Tender Specification.
(xi)	Design Code	ASME SEC-VIII-DIV-I / IS-2825
(xii)	Code for Tests and Inspections	Shall be hydraulically tested at 1.5 times of Design Pressure or



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		2 times of the Working Pressure, whichever is higher, for a period not less than one (1) hour.
(xiii)	Ion Exchange Resins	
	a) Type	Styrene-divinyl benzene matrix with sulphonates as functional group (gel type with particle size 0.5 to 0.65 mm).
	b) Bed depth in mm	Effective Bed Depth: Minimum 1000. Inert Bed Depth: Minimum 150 at top of Effective Bed.
	c) Percentage freeboard	80 % minimum.
(xiv)	Details of Regeneration of Ion Exchange Resins	
	a) Regenerant	Hydrochloric Acid (IS-265).
	b) Regeneration mode	Counter Current.
	c) Injection	By hard ebonite lined Ejector. One (1) number Density Indicator is Shall be provided by the Bidder at outlet of the Ejector.
	d) Dilution Ratio	Suitably selected by the Bidder to ensure desire concentration for dosing.
	d) Accessories	Each ejector shall be provided by the Bidder with flow indicator on Power Water supply line as well as flow indicator cum transmitter on discharge line.
	f) Regeneration Level	Should be optimum and suitable to prevent leakage of ions.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
(xvii)	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached paintings schedule
(xviii)	Resin Traps	Two (2) numbers for each vessel one (1) at service outlet & other at backwash & rinse outlet
(xix)	Regenerant Distributor	
	a) Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
(xx)	Interface Collector	
	a) Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
	b) Location	150 mm below the top of total Resin bed i.e. at the interface of inert & effective resin bed.
(xxi)	Cleats for Internal Support	SS-316
(xxii)	Under Drain System	
	(a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	(b) Material of Construction	For Header Lateral, Header :MSRL-RC and Lateral: PP/PVC (double decker replacable type) For Strainer on plate, Plate:MSRL & Strainer: PP/PVC (double decker replacable type).
	(c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidderto give access below the bed plate.
(xxiii)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xxiv)	Sight windows	Two (2) numbers One at resin top level and other at backwash space.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xxv)	Hand hole	One (1) number of 150 mm dia. for removal of Ion Exchange Resins.
(xxvi)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxvii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
10.00.00	DEGASSER TOWER	
A)	Numbers Shall be provided by the Bidder	Two (2) [One (1) number is working and one (1) number is standby].
B)	Description for each Tower	
(i)	Type	Forced Draft Type Vertical Cylindrical Packed Tower. Each Tower shall be mounted on each Degassed Water Storage Tank (described hereinafter).
(ii)	Type of fluid to be handled	Decationised Water.
(iii)	Location	Outdoor
(iv)	Design Rated Capacity (Net), m3/hr	Not less than 60
(v)	Maximum and minimum capacity	120% and 20% of normal capacity
(vi)	Carbon Di-Oxide content at outlet of Tower	Carbon Di-Oxide content shall not be more than 5.0 ppm as Carbon Di-Oxide
(vii)	Design Pressure, Kg/cm2.g	Atmospheric
(viii)	Design Temperature in degree Celsius	60
(ix)	Design Code	IS-803
(x)	Code for Tests and Inspections	As specified elsewhere in the Specification
(xi)	Material of Construction	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	• Distributors, Collectors	MSRL-RC
	b) External	As per attached paintings schedule
(xiii)	Fill Material	Polypropylene Raschig/Pall rings.
(xiv)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Vent	Shall be provided by the Bidder
	d) Manhole	Shall be provided by the Bidder, 500 NB
	e) Rain protection	Necessary arrangement in order to prevent rainwater entry needs Shall be provided by the Bidder.
	f) Sample Collection Point	Shall be provided by the Bidder.
	g) Platform complete with handrails for operation	Shall be provided by the Bidder.
	h) Staircase	Shall be provided by the Bidder.
	i) Special accessories	Air outlet duct shall be suitably extended to avoid acid water dripping on buildings, structures and vessels.
11.00.00	DEGASSER AIR BLOWERS	
A)	Number	Three (3) [two (2) numbers are working and One (1) number is standby].



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

B)	Description for each Blower	
(i)	Location	Outdoor.
(ii)	Fluid to be handled	Ambient Air.
(iii)	Service	To transfer Ambient Air, to Degasser Tower.
(iv)	Duty	Continuous.
(v)	Type of Blower	Centrifugal, oil free
(vi)	Type of Impeller	Fan Blade.
(vii)	Design standard	As indicated elsewhere in the Specification.
(viii)	Service temperature in degree Celsius	60 maximum.
(ix)	Rated Capacity	50% requirement for one (1) number Degasser Tower.
(x)	Permissible tolerance in rated capacity, in %	As per IS-4894.
(xi)	Head to be developed at rated capacity	Bidder need to indicate, to ensure the satisfactory performance.
(xii)	Permissible tolerance in efficiency at rated capacity, in %	As per IS-4894.
(xiii)	Material of construction	
	a) Casing	Cast Iron or Carbon Steel.
	b) Impeller	Cast Iron or Carbon Steel.
	c) Shaft	EN-8 to BS-970.
	d) Common Base plate	Fabricated Steel as per IS 2062.
	e) Coupling Guard	Carbon Steel.
	f) Nuts and bolts	Carbon Steel.
(xiv)	Type of drive	Electrical Motor
(xv)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no be less than the maximum power required by the Blower.
(xvi)	Rated speed (RPM)	1500 (Sync.) maximum.
(xvii)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ (+5%)
(xviii)	Type of coupling between Blower & Motor	Direct through flexible coupling.
(xix)	Noise level (for complete set of Blower & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
(xx)	Painting for complete set of Blower & Motor	As per attached painting schedule
(xxi)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller and Shaft.
	b) Dynamic Balancing Test	Shall be provided by the Bidder.
(xxii)	Performance Test	
	a) Test Code	As per IS-4894.
	b) Tests to be done for determination of	Head-Capacity Curve and BHP-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of Blower at site	Required.
(xxiii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xxiv)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxv)	Start interlock	Shall be provided by the Bidder.
(xxvi)	Accessories Shall be provided by the Bidder	Common Base Frame, acoustic hood, Suction Filter, Suction Silencer, Discharge Silencer, Discharge Damper.
12.00.00	DEGASSED WATER STORAGE TANK	
A)	Numbers Shall be provided by the Bidder	Two (2) [one (1) number for each chain].
B)	Description for each Tank	
(i)	Type	Vertical cylindrical with roof.
(ii)	Type of fluid to be handled	Decationised and Degassed Water.
(iii)	Effective capacity, in m3	Suitable to store quantity of water required for operation of one (1) number DM stream for an hour and power water requirement for single regeneration of one (1) number complete DM Stream plus overall 20% margin or 100 whichever will be higher.
(iv)	Minimum Free Board, in mm	300
(v)	Design Pressure, Kg/cm2.g	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(vi)	Design Temperature in degree Celsius	60
(vii)	Design Code	IS-803
(viii)	Code for Tests and Inspections	Shall be tested by filling up with water up to the highest level for a period not less than 8 hours.
(ix)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.70.
(x)	Thickness, in mm	Not less than 8.
(xi)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder.
	e) Vent	Shall be provided by the Bidder.
	f) Manhole	Two (2) on shell – Each of minimum 500 mm NB and Davit type.
	g) Sample Collection Point	Shall be provided by the Bidder.
	h) Platform complete with handrails for operation	Shall be provided by the Bidder.
	i) Staircase	Shall be provided by the Bidder for access from ground floor to top of Tank.
(xiii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		line with Bid Specification and Drawings, enclosed with it.
(xiv)	Inlet Control Valve	Shall be provided by the Bidder as per the Tender Specification and Tender P&ID.
13.00.00	DEGASSED WATER TRANSFER PUMPS	
A)	Number	Three (3) [one(1) number under operation another number kept as regeneration stand by and other as maintenance standby]
B)	Description for each Pump	
(i)	Location	Indoor.
(ii)	Fluid to be handled	Decationized and Degassed Water.
(iii)	Service	To transfer Decationized and Degassed Water from Degassed Water Storage Tank to Weakly Basic Anion Exchangers.
(iv)	Duty	Continuous and to be suitable for parallel operation.
(v)	Type of Pump	Horizontal Centrifugal Non Clog type
(vi)	Type of Impeller	Closed
(vii)	Design standard	As per IS-5659 & IS-5120.
(viii)	Service temperature, in degree Celsius	60
(ix)	Rated Capacity, in m3/hr	Not less than 70
(x)	Permissible tolerance in rated capacity, in %	As per IS-5659 & IS-5120.
(xi)	Range of operation	20 % - 120 %.
(xii)	Suction Condition	Flooded.
(xiii)	Head to be developed at rated capacity	As per system requiremnet to meet the requirements as per Tender Specification (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
(xiv)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xv)	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5659 & IS-5120.
(xvi)	Material of construction	
	a) Casing	AISI-316.
	b) Impeller	AISI-316.
	c) Shaft	AISI-316.
	d) Mechanical Seal	AISI-316.
	e) Common Base plate	Fabricated Steel as per IS 2062.
	f) Nuts and bolts	AISI-316.
(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency (± % Variation)	415 V (±10%), 3 Phase, 50 HZ (+5%)
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	Shall be provided by the Bidder
(xxiv)	Performance Test	
	a) Test Code	Hydraulic Institute Standard.
	b) Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of pump at site	Required.
(xxv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxvi)	Suction Strainer along with flushing connection	Required. Material of construction of each strainer shall be SS316.
(xxvii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxviii)	Trip interlock	Shall be provided by the Bidder.
14.00.00	WEAKLY BASIC ANION EXCHANGERS	
A)	Number	Two (2) [one (1) number is working and one (1) number is standby].
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Design Rated Service Flow Rate (Net) in m3/hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m3	Not less than 1080 (Based on 10 % deration on exchange capacity of the resin).
(vi)	Design surface flow rate in m3/m2/hr	Not more than 40.
(vii)	Design Temperature in degree Celsius	60. (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in the Specification.
(viii)	Design Pressure in kg/cm2 (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the stipulations of Tender Specification.
(x)	Design Treated Water Quality	As per the stipulations of Tender Specification.
(xi)	Design Code	ASME SEC-VIII-DIV-I/IS:2825
(xii)	Code for Tests and Inspections	Shall be hydraulically tested at 1.5 times of Design Pressure or 2 times of the Working Pressure, whichever is higher, for a period not less than one (1) hour.
(xiii)	Ion Exchange Resins	
	a) Type	Macro-porous cross linked polystyrene matrix with tertiary amine (minimum 90%) as functional group. (gel type with particle size 0.3 to 1.2 mm).
	b) Bed depth in mm	Minimum 1000.
	c) Percentage freeboard	100 % minimum.
(xiv)	Details of Regeneration of Ion Exchange Resins	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Regenerant	Sodium Hydroxide (IS-252).
	b) Regeneration mode	Co-Current and Thoroughfare with Strongly Basic Anion Exchanger.
	c) Injection	By hard ebonite lined Ejector. One (1) number Density Indicator is Shall be provided by the Bidder at outlet of the Ejector.
	d) Dilution Ratio	Suitably selected by the Bidder to ensure desire concentration for dosing.
	e) Accessories	Each ejector Shall be provided by the Bidder with flow indicator on Power Water supply line as well as flow indicator cum transmitter on discharge line. Temperature indicator on each discharge line Shall be provided by the Bidder for Caustic dosing line.
	f) Regeneration Level	Should be optimum and suitable to prevent leakage of ions.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xvii)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xviii)	Resin Traps	Two (2) numbers one (1) at service outlet and other at backwash & rinse outlet.
(xix)	Regenerant Distributor	
	• Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
(xx)	Cleats for Internal Support	SS-316
(xxi)	Under Drain System	
	a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	b) Material of Construction	For Header Lateral, Header :MSRL-RC and Lateral: PP/PVC (double decker replacable type) For Strainer on plate, Plate:MSRL & Strainer :PP/PVC (double decker replacable type).
	c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidderto give access below the bed plate.
(xxii)	Sight windows	Two (2) numbers
(xxiii)	Hand hole	One (1) number of 150 mm dia. for removal of Ion Exchange Resins.
(xxiv)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
15.00.00	STRONGLY BASIC ANION EXCHANGERS	
A)	Number	Two (2) [One (1) number is working and one (1) number is standby].
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(ii)	Location	Indoor
(iii)	Design Rated Service Flow Rate (Net) in m3/hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	18
(v)	Volume of treated water between two consecutive regenerations (Net), in m3	Not less than 1080 (Based on 10 % deration on exchange capacity of the resin).
(vi)	Design surface flow rate in m3/m2/hr	Not more than 40.
(vii)	Design Temperature in degree Celsius	60 (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in the Specification.
(viii)	Design Pressure in kg/cm2 (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the stipulations of Tender Specification.
(x)	Design Treated Water Quality	As per the stipulations of Tender Specification.
(xi)	Design Code	IS 2825/ASME SEC-VIII-DIV-I
(xii)	Ion Exchange Resins	
	a) Type	Type-I and have macro-porous styrene-divinyl benzene matrix with quaternary ammonium (minimum 95%) type functional group. (gel type with particle size 0.5 to 0.65 mm)
	b) Bed depth in mm	Effective Bed Depth: Minimum 1000. Inert Bed Depth: Minimum 150 at top of Effective Bed.
	c) Percentage freeboard	100 % minimum.
(xiii)	Details of Regeneration of Ion Exchange Resins	
	a) Regenerant	Sodium Hydroxide (IS-252).
	b) Regeneration mode	Counter Current.
	c) Injection	By hard ebonite lined Ejector. One (1) number Density Indicator is Shall be provided by the Bidder at outlet of the Ejector.
	d) Dilution Ratio	Suitably selected by the Bidder to ensure desire concentration for dosing.
	e) Accessories	Each ejector Shall be provided by the Bidder with flow indicator on Power Water supply line as well as flow indicator cum transmitter on discharge line. Temperature indicator on each discharge line Shall be provided by the Bidder for Caustic dosing line.
	f) Regeneration Level	Should be optimum and suitable to prevent leakage of ions.
(xiv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xv)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xvi)	Resin Traps	Two (2) numbers one (1) at service outlet and other at backwash & rinse outlet.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xvii)	Regenerant Distributor	
	Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
(xviii)	Interface Collector	
	(a) Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
	(b) Location	150 mm below the top of total Resin bed i.e. at the interface of inert and effective resin bed.
(xix)	Cleats for Internal Support	SS-316
(xx)	Under Drain System	
	a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	b) Material of Construction	For Header Lateral, Header: MSRL-RC & Lateral: PP/PVC (double decker replaceable type) For Strainer on plate, Plate: MSRL & Strainer: PP/PVC (double decker replaceable type).
	c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidder to give access below the bed plate.
(xxi)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xxii)	Sight windows	Two (2) numbers
(xxiii)	Hand hole	One (1) number of 150 mm dia. for removal of Ion Exchange Resins.
(xxiv)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
16.00.00	MIXED BED EXCHANGERS	
A)	Number	Two (2) [one (1) number is working and one (1) number is standby].
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Design Rated Service Flow Rate (Net) in m3/hr	Not less than 60
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	126
(v)	Volume of treated water between two consecutive regenerations (Net), in m3	Not less than 7560 (Based on 10 % deration on exchange capacity of the resin).
(vi)	Design surface flow rate in m3/m2/hr	Not more than 60.
(vii)	Design Temperature in degree Celsius	60 (for Mechanical Design) Temperature for Regeneration and Backwash are mentioned elsewhere in the Specification.
(viii)	Design Pressure in kg/cm2 (g).	Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.
(ix)	Design Inlet Water Quality	As per the stipulations of Tender Specification.
(x)	Design Treated Water Quality	As per the stipulations of Tender Specification.
(xi)	Design Code	IS2825/ASME SEC-VIII-DIV-I
(xii)	Code for Tests and Inspections	Vessel shall be hydraulically tested at 1.5 times of Design



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		Pressure or 2 times of the Working Pressure, whichever is higher, for a period not less than one (1) hour
(xiii)	Ion Exchange Resins	
	a) Type	Strongly Acidic Polystyrene Resin with DBV cross-linking and High capacity strongly basic Type-I polystyrene resin with DVB crosslinking and quaternary ammonium functional group.
	b) Bed depth in mm	Cation Resin: 500 (minimum) Anion Resin: 500(minimum)
	c) Percentage freeboard	100 % minimum.
(xiv)	Details of Regeneration of Ion Exchange Resins	
	a) Regenerant	Hydrochloric Acid (IS-265) Sodium Hydroxide (IS-252).
	b) Regeneration mode	Co Current.
	c) Injection	By hard ebonite lined Ejectors. One (1) number Density Indicator is Shall be provided by the Bidder at outlet of each Ejector.
	d) Dilution Ratio	Suitably selected by the Bidder to ensure desire concentration for dosing.
	e) Accessories	Each ejector Shall be provided by the Bidderwith flow indicator on Power Water supply line as well as flow indicator on discharge line. Temperature indicator on each discharge line Shall be provided by the Bidderfor Caustic dosing line.
	f) Regeneration Level	Should be optimum and suitable to prevent leakage of ions.
(xv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xvi)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xvii)	Resin Traps	Two (2) numbers one (1) at service outlet and other at backwash & rinse outlet.
(xviii)	Regenerant Distributor	
	• Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
(xix)	Interface Collector	
	(a) Material of Construction	MSRL-RC Header with PP/PVC Laterals complete with PP Strainers (double decker replaceable type)
	(b) Location	At interface of Cation and Anion Resin Bed
(xx)	Cleats for Internal Support	SS-316
(xxi)	Under Drain System	
	(a) Type	Header Lateral or Strainer on plate, designed to avoid any non-uniformity of flow.
	(b) Material of Construction	For Header Lateral, Header :MSRL-RC and Lateral: PP/PVC (double decker replacable type) For Strainer on plate, Plate :MSRL & Strainer :PP/PVC (double decker replacable type).
	(c) Special feature	For Strainer on plate system, an additional manhole Shall be provided by the Bidder to give access below the bed plate.
(xxii)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xxiii)	Sight windows	Two (2) numbers
(xxiv)	Hand hole	One (1) number of 150 mm dia. for removal of Ion Exchange



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		Resins.
(xxv)	Interconnection facility	The outlet of the units shall be interconnected with necessary isolation valves so that any of the units can be used for any stream.
(xxvi)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
17.00.00	AIR BLOWER FOR MIXED BED (COMMON FOR NEUTRALIZATION PIT ALSO)	
A)	Number	Two (2) [one (1) number is working and one (1) number is standby].
B)	Description for each Blower	
(i)	Location	Indoor.
(ii)	Fluid to be handled	Ambient Air.
(iii)	Service	Resin Mixing operation for MB Exchangers and Mixing of Regeneration Waste and Chemicals for effecting neutralization for N.Pit.
(iv)	Duty	Intermittent
(v)	Type of Blower	Rotary, twin lobe
(vi)	Type of Impeller	Fan Blade.
(vii)	Design standard	As indicated elsewhere in the Specification.
(viii)	Service temperature in degree Celsius	60 maximum.
(ix)	Rated Capacity	100% requirement for Two (2) numbers MB Exchangers and N.Pit.
(x)	Permissible tolerance in rated capacity, in %	As per BS-1571
(xi)	Head to be developed at rated capacity	Bidder to indicate, to ensure the satisfactory performance.
(xii)	Permissible tolerance in efficiency at rated capacity, in %	As per BS-1571
(xiii)	Material of construction	
	- Casing - Lobes - Shaft - Common Base plate - Coupling Guard - Nuts and bolts	CI to IS 210 FG 260 CS to BS 970, EN9 Forged CS to BS 970, EN9 Forged Fabricated Steel as per IS 2062. Carbon Steel. Carbon Steel.
(xiv)	Type of drive	Electrical Motor
(xv)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no be less than the maximum power required by the Blower.
(xvi)	Rated speed (RPM)	1500 (Sync.) maximum.
(xvii)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ (+5%)
(xviii)	Type of coupling between Blower & Motor	Direct through flexible coupling.
(xix)	Noise level (for complete set of Blower & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
(xx)	Painting for complete set of Blower & Motor	As per attached painting schedule
(xxi)	Tests and Inspection	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Material Test required for	Casing, Lobe and Shaft.
	b) Dynamic Balancing Test	Shall be provided by the Bidder.
	c) Performance Test	To be provided.
	d) Test Code	As per IS-1571
	e) Tests to be done for determination of	Head-Capacity Curve and BHP-Capacity Curve.
	f) Test to be carried out	On prototype model at rated speed.
	g) Test for satisfactory operation of Blower at site	Required.
(xxii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxiii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxiv)	Accessories Shall be provided by the Bidder	Common Base Frame, Acoustic hood, Suction Filter, Suction Silencer, Discharge Silencer, Discharge Damper.
18.00.00	REGENERATION WATER TRANSFER PUMPS	
A)	Number	Two (2) numbers [One (1) number is working and one (1) number is standby].
B)	Description for each Pump	
(i)	Location	Indoor
(ii)	Fluid to be handled	DM Water
(iii)	Service	To supply DM Water from DM Water Storage Tank for regeneration of Weakly Basic Anion , Strongly Basic Anion and MB Exchangers
(iv)	Duty	Continuous and to be suitable for parallel operation.
(v)	Type of Pump	Horizontal Centrifugal Non Clog type
(vi)	Type of Impeller	Closed
(vii)	Design standard	As per IS-5659 & IS-5120.
(viii)	Service temperature, in degree Celsius	60
(ix)	Rated Capacity, in m3/hr	Suitable to meet the system requirements.
(x)	Permissible tolerance in rated capacity, in %	As per IS-5659 & IS-5120.
(xi)	Range of operation	20 % - 120 %.
(xii)	Suction Condition	Flooded.
(xiii)	Head to be developed at rated capacity	As per system requirement to meet the requirements as per Tender Specification (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
(xiv)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xv)	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5659 & IS-5120.
(xvi)	Material of construction	
	a) Casing	AISI-316.
	b) Impeller	AISI-316.
	c) Shaft	AISI-316.
	d) Mechanical Seal	AISI-316.
	e) Common Base plate	Fabricated Steel as per IS 2062.
	f) Nuts and bolts	AISI-316.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ (+5%)
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	Shall be provided by the Bidder
	d) Performance Test	
	• Test Code	Hydraulic Institute Standard.
	• Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	e) Test to be carried out	On prototype model at rated speed.
	f) Test for satisfactory operation of pump at site	Required.
(xxiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxv)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxvi)	Trip interlock	Shall be provided by the Bidder.
19.00.00	ACID UNLOADING PUMPS	
A)	Number	Two (2) [One (1) number to be under operation and the other as standby].
B)	Description for each Pump	
(i)	Location	Outdoor.
(ii)	Fluid to be handled	Commercial (30 – 33 %) Hydrochloric Acid.
(iii)	Service	To transfer Commercial Hydrochloric Acid from Tank Car to Hydrochloric Acid Storage Tank.
(iv)	Duty	Intermittent and to be suitable for parallel operation.
(v)	Type of Pump	Horizontal Centrifugal Non Clog type
(vi)	Type of Impeller	Semi Open or Open
(vii)	Design standard	As per IS-5639 & IS-5120.
(viii)	Service temperature, in degree Celsius	60
(ix)	Rated Capacity, in m ³ /hr	Not less than 10
(x)	Permissible tolerance in rated capacity, in %	As per IS- IS-5639 & IS-5120.
(xi)	Range of operation	60 % - 120 %.
(xii)	Suction Condition	Flooded.
(xiii)	Head to be developed at rated capacity	Minimum 20 mlc. If necessary, higher value needs to be considered by Bidder to meet the requirements as per Tender Specification (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xiv)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xv)	Permissible tolerance in efficiency at rated capacity, in %	As per IS- IS-5639 & IS-5120.
(xvi)	Material of construction	
	a) Casing	Polypropylene.
	b) Impeller	Polypropylene.
	c) Shaft	Hardened Carbon Steel – EN-8 PP Lined
	d) Mechanical Seal	Polypropylene.
	e) Common Base plate	Fabricated Steel as per IS 2062.
	f) Nuts and bolts	SS-316
(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V (+10%), 3 Phase, 50 HZ (+5%)
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Painting for complete set of Pump & Motor	As per attached painting schedule
(xxiv)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	Shall be provided by the Bidder
(xxv)	Performance Test	
	a) Test Code	Hydraulic Institute Standard.
	b) Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of pump at site	Required.
(xxvi)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxvii)	Suction Strainer along with flushing connection	Shall be provided by the Bidder.
(xxviii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxix)	Trip interlock	Shall be provided by the Bidder.
(xxx)	Accessories to be provided	
	a) Suction Strainer	Required. Material shall be of PP.
	b) Hoses	Two (2) numbers, acid resistant reinforced rubber hoses each 80 mm NB and 20 m (min) long type-2 hose as per IS- 198 / IS- 7654.
20.00.00	ACID STORAGE TANK	
A)	Numbers Shall be provided by the Bidder	Two (2).



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

B)	Description for each Tank	
(i)	Type	Horizontal cylindrical with dished ends, over ground
(ii)	Type of fluid to be handled	Commercial (30 – 33 %) Hydrochloric Acid.
(iii)	Effective capacity of each tank, in m3	Adequate to hold the quantity of regenerant required for regeneration as well as neutralization (if required) with reference to full load operation of overall DM plant for 15 days plus 20% margin.
(iv)	Minimum Free Board, in mm	300.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature in degree Celsius	60
(viii)	Design Code	As indicated elsewhere in the Specification
(ix)	Code for Tests and Inspections	As indicated elsewhere in the Specification.
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 8.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Fume Absorber.
	f) Manhole	Two (2) on shell – Each of minimum 500 mm NB and Davit type.
	g) Sample Collection Point	Shall be provided by the Bidder.
	h) Platform complete with handrails for operation	Shall be provided by the Bidder.
	i) Staircase	Shall be provided by the Bidder for access from ground floor to top of Tank.
(xiv)	Instruments	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Accessories Shall be provided by the Bidder	Fume absorbers, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
21.00.00	ACID MEASURING TANK FOR STRONGLY ACIDIC CATION EXCHANGERS	
A)	Numbers Shall be provided by the Bidder	Two (2).
B)	Description for each Tank	
(i)	Type	Vertical cylindrical with flat bottom.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(ii)	Type of fluid to be handled	Commercial (30 – 33 %) Hydrochloric Acid.
(iii)	Effective capacity, in m3 of each unit	Suitable to meet the requirement for double regenerations of a Weakly Acidic Cation & Strongly Acidic Cation Exchangers plus 20% margin.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature in degree Celsius	60
(viii)	Design Code	As specified elsewhere in the Specification
(ix)	Code for Tests and Inspections	As specified elsewhere in the Specification.
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 6.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Fume Absorber. All fume absorbers shall be externally and internally rubber lined and fasteners shall be of acid proof material.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Accessories Shall be provided by the Bidder	Fume absorbers, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
22.00.00	ACID MEASURING TANK FOR MB EXCHANGERS	
A)	Numbers Shall be provided by the Bidder	One (1).
B)	Description for each Tank	
(i)	Type	Vertical cylindrical with flat bottom.
(ii)	Type of fluid to be handled	Commercial (30 – 33 %) Hydrochloric Acid.
(iii)	Effective capacity, in m3	Suitable to meet the requirement for single regeneration of a MB Exchanger plus 20% margin.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature in degree Celsius	60



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(viii)	Design Code	As specified elsewhere in the Specification.
(ix)	Code for Tests and Inspections	As specified elsewhere in the Specification.
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 6.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Fume Absorber. All fume absorbers shall be externally and internally rubber lined and fasteners shall be of acid proof material.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Accessories Shall be provided by the Bidder.	Fume absorbers, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
23.00.00	ACID MEASURING TANK FOR NEUTRALIZATION PIT	
A)	Numbers Shall be provided by the Bidder	One (1).
B)	Description for each Tank	
(i)	Type	Vertical cylindrical with flat bottom.
(ii)	Type of fluid to be handled	Commercial (30-33 %) Hydrochloric Acid.
(iii)	Effective capacity, in m3	Suitable to meet the requirements for neutralization of excess alkali present in regeneration waste effluent from two DM chains plus 20% margin or 1M3 whichever is higher.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature, degree Celsius	60
(viii)	Design Code	As specified elsewhere in the Specification
(ix)	Code for Tests and Inspections	As specified elsewhere in the Specification
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 6.
(xii)	Protection	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Internal	
	• Material	Natural rubber [shore hardness 60o – 70o A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Fume Absorber. All fume absorbers shall be externally and internally rubber lined and fasteners shall be of acid proof material.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Accessories Shall be provided by the Bidder.	Fume absorbers, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
24.00.00	CAUSTIC UNLOADING PUMPS	
A)	Number	Two (2) [One (1) number to be under operation and the other as standby].
B)	Description for each Pump	
(i)	Location	Outdoor.
(ii)	Fluid to be handled	Commercial (40 – 48 %) Sodium Hydroxide.
(iii)	Service	To transfer Commercial Sodium Hydroxide from Tank Car to Alkali Storage Tank.
(iv)	Duty	Intermittent and to be suitable for parallel operation.
(v)	Type of Pump	Horizontal Centrifugal Non Clog type
(vi)	Type of Impeller	Semi Open or Open
(vii)	Design standard	As per IS-5639 & IS-5120.
(viii)	Service temperature, in degree Celsius	60 maximum.
(ix)	Rated Capacity, in m3/hr	Not less than 10
(x)	Permissible tolerance in rated capacity, in %	As per IS-5639 & IS-5120.
(xi)	Range of operation	60 % - 120 %.
(xii)	Suction Condition	Flooded.
(xiii)	Head to be developed at rated capacity	20 mlc minimum. If necessary, higher value needs to be considered by Bidder to meet the requirements as per Tender Specification (C should be considered as 120 to calculate the frictional loss in pipe as per Hagen Williams Equation).
(xiv)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xv)	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5639 & IS-5120.
(xvi)	Material of construction	
	a) Casing	AISI-316
	b) Impeller	AISI-316
	c) Shaft	SS-410



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	d) Mechanical Seal	AISI-304.
	e) Common Base plate	Fabricated Steel as per IS 2062.
	f) Nuts and bolts	AISI-304.
(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm 10\%$), 3 Phase, 50 HZ (+5%)
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Painting for complete set of Pump & Motor	As per attached painting schedule
(xxiv)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	Shall be provided by the Bidder
(xxv)	Performance Test	
	a) Test Code	Hydraulic Institute Standard.
	b) Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of pump at site	Required.
(xxvi)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxvii)	Suction Strainer along with flushing connection	Shall be provided by the Bidder.
(xxviii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxix)	Trip interlock	Shall be provided by the Bidder.
(xxx)	Accessories to be provided	
	a) Suction Strainer	Required. Material of construction of each strainer shall be SS316.
	b) Hoses	Two (2) numbers, alkali resistant reinforced rubber hoses each 80 mm NB and 20 m long (min) type-2 hose as per IS- 198 / IS- 7654.
25.00.00	CAUSTIC STORAGE TANK	
A)	Numbers Shall be provided by the Bidder	Two (2).
B)	Description for each Tank	
(i)	Type	Horizontal cylindrical with dished ends.
(ii)	Type of fluid to be handled	Commercial (40 – 48%) Sodium Hydroxide.
(iii)	Effective capacity of each tank, in m3	Adequate to hold the quantity of regenerant required for regeneration as well as neutralization (if required) with reference to full load operation of overall DM plant for 15 days plus 20% margin.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm ² .g	As per Tender Specification.
(vii)	Design Temperature in degree Celsius	60
(viii)	Design Code	As indicated elsewhere in the Specification
(ix)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 8.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60° – 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Breather.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Accessories Shall be provided by the Bidder.	CO ₂ absorbers, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
26.00.00	CAUSTIC MEASURING TANK FOR STRONGLY BASIC ANION UNITS	
A)	Numbers Shall be provided by the Bidder	Two (2).
B)	Description for each Tank	
(i)	Type	Horizontal cylindrical with dished ends.
(ii)	Type of fluid to be handled	Commercial (40 - 48 %) Sodium Hydroxide.
(iii)	Effective capacity of each tank, in m ³	Adequate to hold the quantity of regenerant required for double dose regeneration of Weakly Basic Anion & Strongly Basic Anion Exchangers plus 20% margin.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm ² .g	As per Tender Specification.
(vii)	Design Temperature, degree Celsius	60
(viii)	Design Code	As indicated elsewhere in the Specification
(ix)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(x)	Material of Construction	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	c) Thickness, in mm	Not less than 6.
	d) Protection	
	➤ Internal	
	• Material	Natural rubber [shore hardness 60° - 70° A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	• External	As per attached painting schedule
(xi)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Breather.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xiii)	Stirrer per tank	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. Material of Construction of each stirrer and agitator = Stainless Steel – 316.
(xiv)	Accessories	Carbon dioxide absorber, vent, drain, sample connection, level transmitter, operating platform, ladders, lifting lugs (4 nos minimum) etc.
27.00.00	CAUSTIC MEASURING TANK FOR MB UNITS	
A)	Numbers Shall be provided by the Bidder	One (1).
B)	Description for each Tank	
(i)	Type	Horizontal cylindrical with dished ends.
(ii)	Type of fluid to be handled	Commercial (40 - 48 %) Sodium Hydroxide.
(iii)	Effective capacity of each tank, in m3	Adequate to hold the quantity of regenerant required for single regeneration of MB Exchangers + 20% margin.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature, degree Celsius	60
(viii)	Design Code	As indicated elsewhere in the Specification
(ix)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 6.
(xii)	Protection	
	a) Internal	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	b) Material	Natural rubber [shore hardness 60o – 70o A], suitable to withstand the design temperature.
	c) Thickness	4.5 mm in three (3) layers.
	External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Breather.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Stirrer per tank	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. Material of Construction of each stirrer and agitator = Stainless Steel – 316.
(xvi)	Accessories	Carbon dioxide absorber, vent, drain, sample connection, level transmitter, operating platform, ladders, lifting lugs (4 nos minimum) etc.
28.00.00	CAUSTIC MEASURING TANKS FOR NEUTRALIZATION PIT	
A)	Numbers Shall be provided by the Bidder	One (1).
B)	Description for each Tank	
(i)	Type	Horizontal cylindrical with dished ends.
(ii)	Type of fluid to be handled	Commercial (40 - 48 %) Sodium Hydroxide.
(iii)	Effective capacity, in m3	Adequate to hold the quantity of regenerant required for neutralizing excess acid of one regeneration of two DM chains + 20% margin or 1M3 whichever is higher.
(iv)	Minimum Free Board, in mm	300 in addition to above specified margin.
(v)	Size	Bidder need to indicate.
(vi)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(vii)	Design Temperature, degree Celsius	60
(viii)	Design Code	As indicated elsewhere in the Specification
(ix)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(x)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xi)	Thickness, in mm	Not less than 6.
(xii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60o – 70o A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule
(xiii)	Provided with accessories as follows:	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Breather.
	f) Sample Collection Point	Shall be provided by the Bidder.
(xiv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xv)	Stirrer per tank	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. Material of Construction of each stirrer and agitator = Stainless Steel – 316.
(xvi)	Accessories	Carbon dioxide absorber, vent, drain, sample connection, level transmitter, operating platform, ladders, lifting lugs (4 nos minimum) etc.
29.00.00	ACTIVATED CARBON FILTER FOR ALKALI SERVICE	
A)	Number	One (1).
B)	Description for each unit	
(i)	Type	Vertical cylindrical with dished ends.
(ii)	Location	Indoor.
(iii)	Effective Capacity in m ³ /hr	Not less than 10
(iv)	Time Period for each Service Cycle between two consecutive regenerations, in hrs	24.
(v)	Design surface flow rate in m ³ /m ² /hr	Not more than 15.
(vi)	Design Temperature in in degree Celsius	60.
(vii)	Design Pressure in kg/cm ² (g).	Same as Strongly Basic Anion Exchanger
(viii)	Design Inlet Alkali Quality	Bidder need to specify.
(ix)	Design Treated Alkali Quality	Bidder need to specify based on requirements with reference to safe use for regeneration of ion exchange resins. .
(x)	Design Code	As per the requirements of Tender Specification.
(xi)	Code for Tests and Inspections	As per the requirements of Tender Specification.
(xii)	Filter Media	
	a) Type	Activated Carbon.
	b) Characteristics of Activated carbon	Grade : Suitable Grade. Bulk Density : Not less than 400 kg/m ³ . Particle Density wetted in water : 1.3-1.4 gm/cc. Effective size, mm : 0.8-0.9 mm. Uniformity Coefficient : 1.5-1.6. Mean particle dia : 1.2-1.4 mm. Total surface area : Not less than 850 m ² /gm. Iodine number : Minimum 900. Carbon content : Not less than 90%. Moisture content : 5% (max). Ash content : 8% (max).
	c) Bed depth in mm	Activated Carbon -minimum 1200 and Support Gravel - minimum 300.
	d) Percentage freeboard	75 % minimum.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xiii)	Details of Regeneration of Filter Media	
	a) Backwash	Backwash by de-anionized water.
	b) Backwash Velocity	To be specified by the Bidder.
(xiv)	Material of construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.60/70 or better.
	b) Dished ends	Carbon steel as per IS 2002 or ASTM A 515 Gr.60/70 or better.
(xv)	Protection	
	a) Internal	
	• Material	Three (3) coats of Solvent Free Epoxy.
	• Thickness	As per the requirements of Tender Specification.
	b) External	As per attached painting schedule
(xvi)	Design code	ASME SEC-VIII Div-I
(xvii)	Hydrostatic Test Pressure	1.5 times of Design Pressure.
(xviii)	Influent Distributor Material	SS-316
(xix)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xx)	Sight windows	One (1) number in Backwash Space.
(xxi)	Hand hole	One (1) number of 150 mm dia. for removal of Activated Carbon.
(xxii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
30.00.00	ALKALINE BRINE SOLUTION PREPARATION TANK	
A)	Numbers Shall be provided by the Bidder	One (1).
B)	Description for each Tank	
(i)	Type	Vertical cylindrical with flat bottom.
(ii)	Location	Indoor.
(iii)	Type of fluid to be handled	Alkaline Brine Solution.
(iv)	Effective capacity, in m3	Not less than five (5) bed volumes of resin in one (1) number Strongly Basic Anion Exchanger.
(v)	Minimum Free Board, in mm	300 in addition to above specified margin.
(vi)	Size	Bidder need to indicate.
(vii)	Design Pressure, Kg/cm2.g	As per Tender Specification.
(viii)	Design Temperature, degree Celsius	60
(ix)	Design Code	As indicated elsewhere in the Specification
(x)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(xi)	Material of Construction	
	a) Shell	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
	b) Dished Ends	Carbon steel as per IS 2062 or ASTM A 515 Gr.70.
(xii)	Thickness, in mm	Not less than 6.
(xiii)	Protection	
	a) Internal	
	• Material	Natural rubber [shore hardness 60o – 70o A], suitable to withstand the design temperature.
	• Thickness	4.5 mm in three (3) layers.
	b) External	As per attached painting schedule



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(xiv)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Drain	Shall be provided by the Bidder.
	d) Overflow	Shall be provided by the Bidder complete with Overflow Seal.
	e) Vent	Shall be provided by the Bidder complete with Breather.
	f) Agitator along with drive motor and other accessories	Shall be provided by the Bidder. Slow speed agitator driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. All wetted parts of the Agitator – Hastelloy C or SS-316 L.
	g) Sample Collection Point	Shall be provided by the Bidder.
	h) Special accessories	Solution Preparation Basket of SS-316 Construction needs to be provided.
(xv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
31.00.00	DILUTION WATER HEATER FOR ALKALI	
A)	Number	One (1).
B)	Description for each unit	
(i)	Type	Vessel - vertical cylindrical with dished ends. Heater – Immersion Coil or Nichrome type
(ii)	Location	Indoor.
(iii)	Type of fluid to be handled	Treated water from Strongly Basic Anion Exchanger.
(iv)	Effective Capacity in m ³	Not less than the volume of power water required for single regeneration of one (1) number Strongly Basic Anion Exchanger at 40 degree C plus 20% margin.
(v)	Design Temperature in degree Celsius	60
(vi)	Design Pressure in kg/cm ² (g).	Same as Strongly Basic Anion Exchanger
(vii)	Design Code	IS2825/ASME SEC-VIII DIV-I
(viii)	Code for Tests and Inspections	As indicated elsewhere in the Specification.
(ix)	Material of construction	
	a) Shell	SS-316.
	b) Dished ends	SS-316.
(x)	Manhole	Two (2) numbers minimum each of Davit type and 500 mm dia.
(xi)	Insulation	Adequately insulated to restrict the outside temperature to 60 deg. C with 25 mm thick (mm) mineral wool insulation on all external surfaces, covered with 16 gauge galvanized iron sheet jacketing.
(xii)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
32.00.00	HEATER DATA	
A)	Type	Immersion Coil type with Thermostat
B)	Number of Heating element	As required to get the desire heating
(i)	Insulation Material	MGO fused powder or equivalent refractory block
(ii)	Heating Time in hrs.	Maximum 4
(iii)	Instrumentation	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	- Pressure Relief Valve - Temperature Indicator - Temperature indicator controller	Shall be provided by the Bidder Local as well as panel mounted One (1) no, panel mounted to control the water temperature. Controller shall have auto and manual selection mode.
(iv)	Control Valves	
	a) Number and Location	Two (2) nos., at the inlet line of the Heat Exchanger
	b) Material	Stem, Plug and Seat: SS-316 Body : Cast Iron
	c) Actuators	Pneumatic with local handwheel. Valve shall be modulating type.
33.00.00	NEUTRALIZATION PIT	
A)	Numbers Shall be provided by the Bidder	One (1) with two compartments.
B)	Description for each Tank	
(i)	Location	Outdoor.
(ii)	Type	Underground and rectangular in cross-section.
(iii)	Type of fluid to be handled	Regeneration Waste Water.
(iv)	Effective capacity of each compartment, in m3	Suitable to hold waste effluent generated from regeneration of one (1) number complete DM chain + 20% overall margin.
(v)	Size	Bidder need to indicate.
(vi)	Liquid depth in m	3.5 (minimum)
(vii)	Free board in mm	500 (minimum)
(viii)	Design Temperature, °C	60
(ix)	Design Code	As indicated elsewhere in the Specification.
(x)	Code for Tests and Inspections	As indicated elsewhere in the Specification
(xi)	Material of Construction	RCC.
(xii)	Thickness, in mm	As indicated elsewhere in the Specification
(xiii)	Protection	
	a) Internal	Acid and Alkali Proof Tiles / Lining
(xiv)	Provided with accessories as follows:	
	a) Inlet	Shall be provided by the Bidder.
	b) Outlet	Shall be provided by the Bidder.
	c) Platform complete with handrails for operation	Shall be provided by the Bidder
	d) Special accessories	Shall be provided by the Bidder
	- Air Grid Arrangement - Inlet Gate (bidder's scope)	Required in each chamber for air agitation to achieve better mixing and economy in chemical consumption. Separate Inlet Gate Shall be provided by the Bidder for each Compartment
(xv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
34.00.00	NEUTRALIZED EFFLUENT DISPOSAL PUMPS	
A)	Number	Two (2) numbers [one (1) number to be under operation and the other as standby]
B)	Description for each Pump	
(i)	Location	Outdoor.
(ii)	Fluid to be handled	Regeneration waste.
(iii)	Service	Recirculation of regeneration waste and disposal of neutralized regeneration waste.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

(iv)	Duty	Continuous and to be suitable for parallel operation.
(v)	Type of Pump	Horizontal Centrifugal Non Clog type
(vi)	Type of Impeller	Closed
(vii)	Design standard	As per IS-5120 & IS-5659.
(viii)	Service temperature, in degree Celsius	60
(ix)	Rated Capacity, in m3/hr	Not less than 50.
(x)	Permissible tolerance in rated capacity, in %	As per IS-5120 & IS-5659.
(xi)	Range of operation	20 % - 120 %.
(xii)	Suction Condition	Suction Lift required.
(xiii)	Head to be developed at rated capacity	Suitable to meet the system requirements.
(xiv)	Shut Off Head	To be suitable for stable operation at rated duty point.
(xv)	Permissible tolerance in efficiency at rated capacity, in %	As per IS-5120 & IS-5659.
(xvi)	Material of construction	
	a) Casing	AISI-316.
	b) Impeller	AISI-316.
	c) Shaft	AISI-316.
	d) Mechanical Seal	AISI-316.
	e) Common Base plate	Fabricated Steel as per IS 2062.
	f) Nuts and bolts	AISI-316.
(xvii)	Type of drive	Electrical Motor
(xviii)	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
(xix)	Rated speed (RPM)	1500 (Sync.) maximum.
(xx)	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm$ 10%), 3 Phase, 50 HZ ($\pm$ 5%)
(xxi)	Type of coupling between Pump & Motor	Flexible Spacer.
(xxii)	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).
(xxiii)	Tests and Inspection	
	a) Material Test required for	Casing, Impeller, Shaft and Shaft Sleeve.
	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	To be provided
(xxiv)	Performance Test	
	a) Test Code	Hydraulic Institute Standard.
	b) Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of pump at site	Required.
(xxv)	Instruments, alarm and Interlock	Shall be provided by the Bidder as per system requirements in line with Bid Specification and Drawings, enclosed with it.
(xxvi)	Suction Strainer along with flushing	Shall be provided by the Bidder. Material of each strainer shall



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	connection	be SS316.
(xxvii)	Start and stop facility provided both at local and panel	Shall be provided by the Bidder in conjunction with Auto Start Facility.
(xxviii)	Trip interlock	To be provided.
35.00.00	POTABLE WATER PUMPS	
(i)	Service	Drinking/ potable water
(ii)	Designation	Potable water Pumps
(iii)	Duty	Intermittent
(iv)	Location	Indoor
(v)	Number of Pumps required	Two (2)
(vi)	Number of pumps working	One (1)
(vii)	Number of pumps standby	One (1)
(viii)	Liquid handled	Filtered Water
(ix)	Design Temperature in degree Celsius	60
(x)	Suction Lift/ Head available (MLC)	Flooded suction shall be ensured
(xi)	Pump Performance Requirements	
	a) Rated Capacity (Cu.m/hr)	Not less than 50 M3/Hr.
	b) Total Dynamic Head as per IS-5120 at Rated Capacity (MLC)	To be specified by the Bidder considering 10% margin to meet the requirements of the system as per Bid Specification. (C should be considered as 120 to calculate frictional loss in pipe as per Hagen Williams Equation).
	c) Static head in MLC (minimum)	42 meters
	d) Rated Speed (rpm) Max	1500
	e) Noise Level	85 dBA
	f) Permissible Tolerance in Rated Capacity (%)	As per IS:6595
	g) Permissible Tolerance in Efficiency at Rated Capacity (%)	No Negative tolerance
	h) Range of Operations	between 75% to 130% of rated capacity
(xii)	Design Standard	Hydraulic Institute Standard /IS-5120/ Equivalent Standard
(xiii)	Impeller Type	Closed
(xiv)	Type of Gland Lubrication and Sealing	Self-water
(xv)	Shaft Sealing Arrangement	Mechanical Seal
(xvi)	Type of Pump-motor Connection	Direct
(xvii)	Type of Coupling	Flexible
(xviii)	Mode of Pump Starting	Discharge Valve Fully Closed
(xix)	Material of Construction	
a)	Casing	IS 210 FG 260
b)	Casing Liner	ASTM-A743 Gr. CF8M
c)	Diffuser	ASTM-A743 Gr. CF8M
d)	Impeller	ASTM-A743 Gr. CF8M
e)	Wearing Rings	ASTM-A743 Gr. C440
f)	Shaft	ASTM-A276 Gr.410
g)	Shaft Seal	ASTM-A276 Gr.316
h)	Mechanical Seal	Manufacturer's Standard



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

i)	Base Plate	IS 2062
j)	Wetted Fastner	Stainless Steel AISI-304
(xx)	Supply of Accessories & Services	
a)	Base Plate	Shall be provided by the bidder
b)	Foundation Bolts, Nuts, Sleeves etc.	Shall be provided by the bidder
c)	Suction and Discharge Companion Flanges with Bolts, Nuts and Gaskets	Shall be provided by the bidder
d)	Gland Sealing and Cooling Arrangement	Shall be provided by the bidder
e)	Bearing Lubrication and Cooling Arrangement	Shall be provided by the bidder
f)	Suction and discharge pressure Indicator	Shall be provided by the bidder
g)	Priming Connection with 3- way SS Isolating Valve	Shall be provided by the bidder
h)	Pump-motor Coupling Guard	Shall be provided by the bidder
i)	Vent with 3-way SS Isolating Valve	Shall be provided by the bidder
j)	Drain Connection with Valve	Shall be provided by the bidder
k)	Eye-bolts, Lifting Tackle etc.	Shall be provided by the bidder
(xxi)	Inspection and Testing	As indicated elsewhere in the specification.

DATASHEET OF PIPING & VALVES FOR DM PLANT

1.0	PIPING	
SL NO.	SERVICE	MATERIAL
1.1	Raw water piping, Clarified Water piping, service water piping	Carbon Steel IS-1239 Heavy Grade upto 150 mm NB and IS-3589 for sizes above 150 mm with minimum pipe thickness of 6 mm.
1.2	Potable Water piping.	Carbon Steel IS-1239 Heavy Grade upto 150 mm NB and IS-3589 for sizes above 150 mm with minimum pipe thickness of 6mm. The pipes shall be galvanized as per IS-4736.
1.3	Demineralised water, Service and	Stainless Steel as per ASTM A- 312 Gr. 304. Size- as per schedule 40 ANSI B36.10



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

	Instrument Air Piping less than and equal to 50 mm NB.	
1.4	Demineralised water, Service and Instrument air piping for sizes equal to greater than 65 mm NB.	Stainless steel as per ASTM A-312 Gr. 304. Size-up to 150 mm NB as per schedule 10S, ANSI B-36.10.
1.5	Filtered Water, Degassed Water, Neutralized Wastewater, De cationized water	ERW Carbon Steel Pipe to ASTM 53 Gr. B / IS-1239, Part-I heavy grade for pipe size up to 150mm NB and IS-3589 for 200mm NB & above (inside rubber lined)
1.6	Hydrochloric Acid (concentrated), Hydrochloric Acid (dilute)	Carbon Steel (inside rubber lined)
1.7	Sodium Hydroxide (concentrated), Sodium Hydroxide (dilute)	Carbon Steel (inside rubber lined)
1.8	Sampling Pipe	Stainless Steel to ASTM Schedule-10.
	Notes: 1. For demineralised water, stainless steel shall be used for sizes of 50mm NB and below. For small diameter pipe (≤ 50 mm NB), where rubber lining is difficult, CPVC Sch. 80 (minimum) shall be used for hydrochloric acid and stainless steel pipe instead of rubber lined steel pipe shall be used for other services.	
2.0	VALVES & GATES	
2.1	Raw water, clarified water, filtered water.	CAST IRON BODY BUTTERFLY VALVES : i. Basic Design Code: All the Butterfly valves shall be of double flanged type of low leakage rate confirming to AWWA-C-504 class 150 (min.). ii. Material of construction • Body: 2% Ni Cast Iron as per IS-210 Gr. FG260 with 2% Ni. • Valve Disc: 2% Ni Cast Iron as per IS-210 Gr. FG260 with 2% Ni. • Shaft: Stainless Steel ASTM-A-479 type 304. • Seat ring: Clamping ring Stainless Steel ASTM-A-479 type 304. • Shaft Bearing: Ferrobestos LA-33. • Gland Packing: Impregnated Teflon • Seal: Nitrile Rubber iii. Construction: Cast Body and Disc iv. Valve classification Code: CIBF v. Pressure: To be suitably chosen by the Bidder according to requirement, but not less than class 75A as per AWWA-C-504. vi. All the butterfly valves shall be provided by the Bidder with Hand wheel or lever as per the requirements. vii. End preparation: Flanged, Drilled as per ANSI B16.1. Necessary counter flange nuts, bolts, gaskets are to be provided with each valve. viii. Testing: As per AWWA-C-504. However valve disc strength for both forward reverse flow is to be carried out as per BS5155. Certificate for proof of design test for similar type of valve is to be furnished by the bidder. ix. All the butterfly valves shall be provided by the Bidder with an indicator to show the position of the disc.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

2.2	Decationised, Deanionised and Demineralised water application	Butterfly valves or Diaphragm valves shall be used for this application. <u>Diaphragm Valve</u> The Diaphragm shall conform to following requirement i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10). ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type iii) Material of Construction - Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB - Body lining : Soft natural rubber, ebonite , Polypropelene - Handwheel : Cast Iron - Compressor : Stainless Steel - Stem and Bush : Stainless Steel <u>Butterfly Valve</u> The butterfly valves shall conform to CL Number 2.1 above except for the following requirements: - Body shall be lined (minimum 3 mm) with natural rubber, ebonite, polypropylene or PVDF. - Disc shall be lined with PVDF, Polypropylene or natural rubber. - Seat rings shall be of Nitrile rubber or Hypalon.
2.3	Acid and alkali service	Valves shall be of Diaphragm type. These valves shall conform to above (sl number 2.2) except that the diaphragm shall be of reinforced Teflon, EPDM/Black Butyl/ approved equivalent for acid services and reinforced neoprene/Hypalon/approved equivalent for alkali services and body and bonnet shall be of SS316.
2.4	Non return valve	These valves shall be swing check type or dual plate type Swing check type (non corrosive application) Body and disc : Cast iron Hinge pin and door/disc pin: Cast steel ASTM A216 Gr.WCB Disc facing ring: stainless steel Body Seat ring: Stainless steel For application of lime, corrosive water (DM water, decationised /deanionised water), and air,the body,cover and disc shall be lined with natural rubber,PTFE or Viton. Bolting shall be stainless steel. For acid services, the valves shall be of lined construction as specified above and body/disc facingring shall be of resilient materials such as natural rubber, PTFE or Viton. For alkali service, the complete valve shall be stainless steel construction (SS316).
2.5	Service Water, Clarified Water, Potable Water.	<u>CAST IRON BODY GATE/GLOBE/CHECK VALVE</u> - Size: For sizes 65mm NB and above. - Valve Classification Code : CIGC - Basic Design Code - Gate valve - IS 780 for 50 mm - 300 mm NB - Gate valve - IS2906 for 350 mm NB and above or as per MSS-SP-70 - Globe valve - MSS - SP – 85 - Check valve - IS-5312/MSS - SP -71 - Ball - BS-5351 - Pressure Class - To be suitably chosen considering the pressure requirement as indicated below: Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher. - Construction: Cast body and bonnet / cover <u>Material of Construction</u>



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		- Body & Bonnet/ cover: IS 210 Gr. FG 260 - Trim / Disc.: IS-210 Gr. FG 260 - Seating surface: 13% Cr steel as per IS 1570 - End Preparation: Socket welded for size equal to and below 50mm NB and flanged with counter flanges for 65mm NB and above. vi. Testing - Gate: As per IS - 780 for 50 mm - 300 mm NB - Gate: IS-2906 for sizes equal to and above 350 mm NB - Globe: Hydrostatic Test as per MSS-SP-85 - Check: S-5312/MSS-SP-71
2.6	Potable Water, Service and Instrument Air.	<u>STAINLESS STEEL BODY/ GATE/GLOBE /CHECK/BALL VALVE</u> i. Service: Potable Water, Service and Instrument Air. ii. Sizes: - Potable Water - For sizes less than and equal to 50 mm NB. - Service and Instrument Air- For all sizes. Ball valves shall be used in air line. iii. Valve Classification Code : SSGC iv. Basic Design Code - Gate valve - ANSI-B-16.34 - Globe valve - ANSI-B-16.34 - Check valve - ANSI-B-16.34 - Ball - BS-5351 v. Pressure Class - To be suitably chosen considering the pressure requirement as indicated below: Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher. vi. Construction: Forged body up to 50mm NB and Cast body above that vii. Material of Construction - Body & Bonnet/ cover: ASTM-A-182 F304 for Ball Valves: - Body & Bonnet/ cover: A351 CF8M for cast body, A 182 F304 for forged body, - Trim / Disc.: ASTM-A-182 F304 for Gate, Globe, Check valves and 351CF 8M for Ball valves. - Seating surface: 13% Cr steel as per IS 1570. For Ball valves PTFE seats and seals. - End Preparation: Socket welded for size equal to and below 50mm NB and flanged with counter flanges for 65mm NB and above. viii. Testing : As per ANSI B-16.34
2.7	Isolation Gates For Filter Backwash Sump	i. Four numbers gate Shall be provided by the Bidder. ii. Design standard for each gate shall be IS:3042 or Eqv. iii. The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS:3042. iv. Material of Construction of each gate: - Frame and Door: Cast Iron IS:210 Gr. 20 - Spindles, bolts & nuts : M.S. to IS:2062 - Face & seat rings: Gun metal (as per IS:3042). - All the parts of each gates shall be applied with the coats of heavy duty bitumastic paint. - Each of the gates shall be provided by the Bidder with hand wheel, and a position indicator. - Each gate shall be FRP coated on both sides.
2.8	Isolation Gates For Neutralisation pit	i. Four numbers gate Shall be provided by the Bidder. ii. Design standard for each gate shall be IS:3042 or Eqv.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

		iii. The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS:3042. iv. Material of Construction of each gate: • Frame and Door: Cast Iron IS:210 Gr. 20 • Spindles, bolts & nuts : M.S. to IS:2062 • Face & seat rings: Gun metal (as per IS:3042). • All the parts of each gates shall be applied with the coats of heavy duty bitumastic paint. • Each of the gates shall be provided by the Bidder with hand wheel, and a position indicator. • Each gate shall be FRP coated on both sides.

Notes:

- 1) Other valves used in Acid / alkali service, the material of complete valve shall be of SS316 only.

PUMPS AND PIPE SELECTION CRITERIA

Pipe Size	Velocity in m/sec		
	Below 50 mm	50 mm - 150 mm	200 mm & above
Pump Suction for Water		1.2 - 1.5	1.2 - 1.8
Pump Discharge for Water	1.2 - 1.8	1.8 - 2.4	2.1 - 2.5
Header		1.5 - 2.4	2.1 - 2.4
Compressed air below 2 Kg/cm ² (g)	15 - 20	20 - 30	25 - 35
Compressed air 2 Kg/cm ² & above	20 - 30	25 - 40	35 - 45
Suction to compressor/ Blowers		7-8	
Pump Suction for Chemical Solution	1.0 - 1.2	1.1 - 1.3	
Pump Discharge for Chemical Solution	1.2 - 1.4	1.3 - 1.5	

Note:

1. Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally.
2. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

P&ID FOR DM PLANT



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

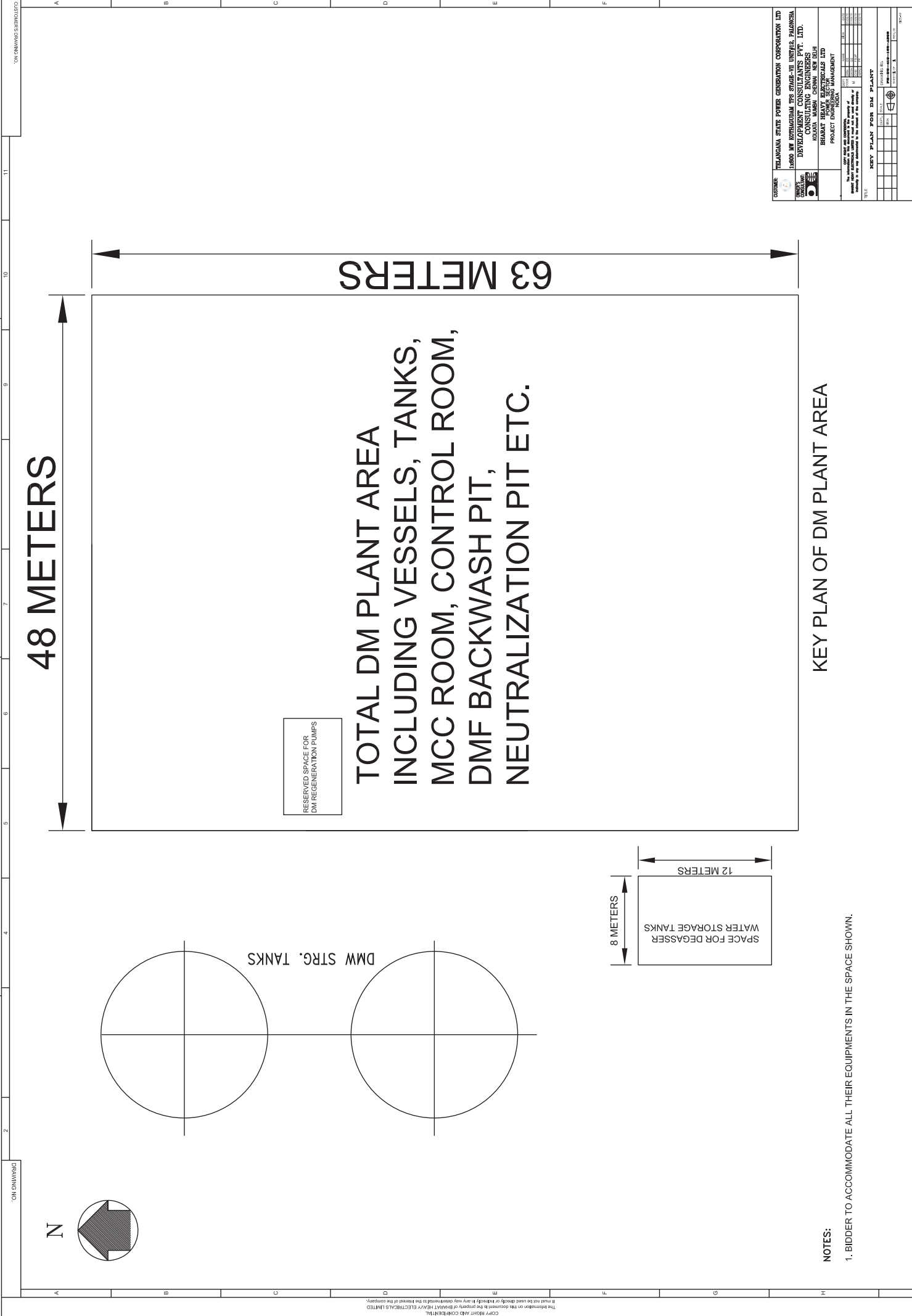
VOLUME: II-B

SECTION: C1

REV NO: 00

DATE:

KEY PLAN FOR DM PLANT





TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

SECTION – C2
SPECIFIC TECHNICAL REQUIREMENTS
ELECTRICAL



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

- 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 bidder without any extra charge shall provide the same.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for DM/ Pre-Treatment/ Effluent Treatment and Sewage Treatment Plant.
- 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 including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc. shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.
- h) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.
- i) Motors shall meet minimum requirement of Electric motor specification.
- j) All routine tests and type tests reports as per applicable standards shall be furnished at contract stage.
- k) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.
- l) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- m) 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.

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 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical / quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
 - a) A copy of this sheet "Electrical Equipment Specification for DM/ Pre-Treatment/ Effluent Treatment/ Sewage Treatment Plant and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - b) Electrical load requirement.
 - c) If there is any conflict, customer motor specification will prevail over BHEL motor specification.
- 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:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor
- 4.2 Technical specification – Specification for Electric Motors/Actuators
- 4.3 Datasheets & quality plan for motors.
- 4.4 Load Data Format. (Annexure –II)
- 4.5 BHEL Cable listing format (Annexure –III)



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

ELECTRICAL SCOPE BETWEEN BHEL & VENDOR

REV-0, DATE: 09.03.2015

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: **DM PLANT**

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1X800 MW KOTHAGUDEM TPS

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	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.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	

REV-0, DATE: 09.03.2015

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: **DM PLANT**

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1X800 MW KOTHAGUDEM TPS

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. 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.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

ELECTRICAL LOAD DATA FORMAT

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA LOAD RKS No.	VERIFICATI ON FROM MOTOR DATASHEE T (Y/N)	KKS NO	
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ANNEXURE-II																				
NOTES:																				
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER																				
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V																				
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)																				
LOAD DATA (ELECTRICAL)	JOB NO.	410		ORIGINATING AGENCY		PEM (ELECTRICAL)														
	PROJECT TITLE	1X800 MW KOTHAGUDEM TPS		NAME		DATA FILLED UP ON														
	SYSTEM	DM PLANT		SIGN.		DATA ENTERED ON														
	DEPTT. / SECTION	MAX		SHEET 1 OF 1		REV. 00		DE'S SIGN. & DATE												



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C2

REV NO: 00

DATE:

CABLE SCHEDULE FORMAT

ANNEXURE III

UNIT CABLE NO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLE SIZE	PATH CABLE NO	TENTATIVE CABLE LENGTH



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C3

REV NO: 00

DATE:

SECTION – C3
SPECIFIC TECHNICAL REQUIREMENTS
C&I



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C3

REV NO: 00

DATE:

1. Bidder to include Field instrumentation and Field Junction Box (JB's), in his scope of supply. Field instrument specification and Data Sheet are given elsewhere in this spec.
2. All fields cabling for instruments/motor/pump/blower to JB is in bidder's scope and details are given elsewhere in this spec. JB to PLC shall be provided by BHEL as free issue whereas cable schedule, cable interconnections and wiring diagram for the same shall be in bidders' scope.
3. Instrument installation drawings are to be provided by bidder. All instrument fitting and erection hardware as per instrument installation diagram shall be in bidder's scope.
4. All manual valves at pump discharge shall be provided with Open and Close Limit Switches.
5. PLC control system as defined in the enclosed specs and DATA Sheets shall be in bidder scope. The PLC system shall comprise of (i) PLC based local panel (ii) UPS Power supply (iii) Operator interface in the form of CRT, keyboard and OWS along with required furniture.
6. PLC shall have the facility to synchronize its time with BHEL supplied GPS. Necessary Hardware (IRIG-B port) for same at PLC end to be provided by bidder. The cable connecting PLC and GPS shall be in BHEL scope.
7. PLC shall be connected to DCS through serial link with OPC Compliant for monitoring/Control. For detailed , please refer PLC Architecture Diagram.
8. All furniture (tables, chairs etc.) required for PLC operator HMI shall be in bidder's scope. Chairs shall be capable of being adjusted for height and position of backrest. The chairs shall be mounted on five castors, shall swivel and shall have arm rests'. One table and chair shall be provided for each operator station and separate table for each printer.
9. The requirements given below are to be read in conjunction with detailed Technical specification enclosed.
10. For any other cable type, the scope of cable and cable type in 'Electrical scope split sheet' in Electrical portion of the specification shall be final.
11. Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C3

REV NO: 00

DATE:

12. Supplied system shall provide group alarms to be hardwired to plant DCS.
13. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.
14. Provision for earthing of the panel to be provided by vendor.
15. Vendor to submit GA drawing of control panel indicating layout of instruments, construction details, wiring diagram, class of protection for enclosure, paint type, paint color, thickness and material of enclosure sheet, control scheme during detailed engineering.
16. Layout & space requirement of panel to be specified during detailed engineering.
17. All bidirectional drives (Motor Operated Valves, MOVs) are integral starter type. Typical Hook Up diagram of all types of drives is attached for use(subject to Customer approval).
18. Bidder shall provide Cable Schedule in BHEL excel format provided in Electrical portion of the specification. Also, Cable Interconnections details for Complete System shall be in Bidders' scope.
19. 415 V AC (3 Phase, 3 Wire) supply shall be provided by BHEL at a single point as per 'Electrical scope split sheet' in Electrical portion of the specification. Further distribution to various instruments/Equipment shall be in Bidder's scope. Bidder to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Bidder's scope.
20. Bidder to provide all control panels, system cabinets, termination & relay cabinets complete with all accessories, wiring and all mounting and erection hardware including junction boxes, canopies, structural steel as required. All instruments/drives shall be terminated on Junction Boxes/Panel in Bidder scope of supply. 20% Spare terminals shall be provided on Junction Boxes.
21. Bidder to delegate/depute their person/experts as per owner/consultant requirements.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: C3

REV NO: 00

DATE:

22. All the furniture for OWS/ Printer required for the system shall be in bidder's scope of supply.
23. The make of all the items shall be from approved sub-vendor list.
24. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.
25. Bidder shall provide the signal exchange, to Plant DCS in BHEL prescribed format to be furnished during detailed engineering.

NOTES:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: D

REV NO: 00

DATE:

SECTION – D GENERAL TECHNICAL REQUIREMENTS



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT
MECHANICAL



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT FOR
DUAL MEDIA FILTERS AND DM FEED PUMPS



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT FOR DUAL MEDIA FILTERS

- 1) Dual Media Filters will remove the residual suspended impurities in clarified water and the major part of filtered water will be fed to the Activated Carbon Filters (ACF) of Demineralization System and rest part of filtered water will be led to Overhead Filter Backwash Reservoir (located at vicinity of DM Plant Building) and suction of Potable Water Pumps.
- 2) On completion of a service cycle, Dual Media Filters shall be air scoured by means of Air Blowers and then backwashed with filtered water by means of Overhead Filter Backwash Reservoir as envisaged for Demineralization System.
- 3) The backwash water generated from Filter(s) as addressed above will be collected in a Filter Backwash Sump. Backwash Water will be pumped from Filter Backwash Sump by means of two (2) numbers Backwash Waste Water Disposal Pumps to recycle back the water to Stilling Chamber.
- 4) Flow from Clarified Water Reservoir to Dual Media Filter(s) shall be by pumps.
- 5) The design surface flow rate shall not exceed 10.0 m³/hr per m².
- 6) Filter Bed shall consist of Sand and Anthracite. Filter Bed shall be suitable to withstand the maximum pressure drop encountered during the operation without breakdown.
- 7) The Inlet Distribution system shall be designed to give uniform distribution of water over Filter Bed. The under Drain Collection System shall be designed for uniform collection of filtered Water and distribution of backwash water.
- 8) Dual Media Filters shall be located in Demineralization System Building.
- 9) **Air Blower for Dual Media Filter**
 - Air Blowers for Dual Media Filters shall be located in Demineralization System Building.
 - Blowers shall be of Rotary Twin Lobe / Centrifugal type.
- 10) **Overhead Filter Backwash Reservoir**
 - The Overhead Filter Backwash Reservoir shall be constructed over ground.
 - Flow of filtered water from Dual Media Filter(s) to Overhead Filter Backwash Reservoir shall be by pressure available at outlet header of Dual Media Filter(s).
- 11) **Filter Backwash Waste Sump**
 - The Filter Backwash Sump shall be constructed underground.
 - Flow of backwash from Dual Media Filter(s) to Backwash Sump shall be by gravity.
- 12) **Backwash Waste Water Disposal Pumps**
 - Backwash Water Disposal Pumps shall be located in Backwash Pump House.
 - Pumps shall be of vertical centrifugal type.
- 13) DMF Unit will be automatically isolated from the system under the conditions as follows:

DMF Unit : On output of predetermined volume of treated water or high turbidity, whichever occurs earlier.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

14) Performance Guarantee Test Procedure for Dual Media Filtration System:

- Necessary pumps shall be started and flow shall be established through all the streams. Valves shall be adjusted so as to have equal and rated distribution of flow through all the streams.
- One (1) stream shall be running at a time. Samples of water will be drawn every hour from the outlet of DMF and then tested in the laboratory. The results shall be compared against the required parameters stipulated elsewhere under this specification.
- Exhaustion of each Unit shall be indicated by the features described under Operation and Control Philosophy for River Water Pre Treatment System. Units shall then be backwashed at the specified conditions.
- The backwashed stream shall be again put into service and tests in item will be continued. At the end of run (as determined in above, total amount of water treated will be noted from the flow integrators.
- Quantity of treated water as determined by tests as in above shall be checked against guaranteed quantity of treated water during service cycle as in above and must be equal to or more than the guaranteed amount.
- All the above mentioned tests shall be separately done for each of the streams of the DMF Units.
- Each DMF Unit will have a rated continuous treated water output capacity of not less than 75 m³/hr (net) over and above the quantity of treated water required for backwash / regeneration / rinse of itself and other units of the same stream or chain it belongs to. It shall be backwashed once after every 18 hours of continuous service run.
- For each DMF Unit, the guaranteed quantity of filtered water shall not be less than 1350 m³ between two successive backwashes.
- Treated water quality from Solid Contact Clarifiers and Dual Media Filters shall be guaranteed as per Annexure-I.

GENERAL TECHNICAL REQUIREMENT FOR DMF FEED PUMPS

- 1) DMF Feed Pumps shall be located in Clarified Water Pump House.
- 2) Pumps shall take suction from Clarified Water Reservoir and be of vertical centrifugal type.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

ANNEXURE–I

TREATED WATER QUALITY

(DESIGN ANALYSIS OF CLARIFIED WATER)

[After addition of 50 ppm Alum, 20 ppm Lime , 1 ppm Polyelectrolyte and
 5 ppm Chlorine on 100% purity basis]]

DESIGN ANALYSIS OF CLARIFIED WATER:

CONSTITUENTS	As	CONTENT
Calcium	CaCO ₃	128.9 ppm
Magnesium	CaCO ₃	53.52 ppm
Sodium	CaCO ₃	73.44 ppm
Potassium	CaCO ₃	1.02 ppm
Iron in Soln.	Fe	0.1 ppm
Hydrogen (FMA)	CaCO ₃	- ppm
TOTAL CATIONS (except iron)	CaCO ₃	256.88 ppm
Bicarbonate	CaCO ₃	143.4 ppm
Carbonate	CaCO ₃	0.53 ppm
Hydroxide	CaCO ₃	0.02 ppm
Sulphate	CaCO ₃	59.85 ppm
Chloride	CaCO ₃	50.82 ppm
Nitrate	CaCO ₃	1.21 ppm
Phosphate	CaCO ₃	- ppm
Fluoride	CaCO ₃	1.05 ppm
TOTAL ANIONS	CaCO ₃	256.88 ppm
Reactive Silica	SiO ₂	10 ppm
Total Suspended Solid	CaCO ₃	15 ppm (overload condition)
Conductivity at 25 deg C		450 Microsiemens/cm (max)
pH value at 25 ^o C	-	7.62
Turbidity		Not to exceed 15 NTU (max)



TITLE:
**TECHNICAL SPECIFICATION FOR
DM PLANT**
**1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT FOR DM PLANT

VOLUME : III-C
SECTION-II
**DEMINERALISATION SYSTEM & POTABLE WATER
TREATMENT SYSTEM**
(PART-A): DEMINERALISATION SYSTEM
1.00.00 SYSTEM DESCRIPTION

The schematic arrangement of the DM System has been detailed in P&I diagram enclosed with this document. The general description of the DM System is given below:

The DM Water consumptions for various requirements are as follows:

- ◆ DMCW.
- ◆ Heat Cycle Make-Up.
- ◆ Chemical Feed System
- ◆ Condensate Polishing System.

The DM System consists of two (2) X 100% each parallel demineralization streams along with necessary regeneration and storage arrangement. Capacity of each DM stream shall not be less than 60 m³/hr (net). Under normal condition, one (1) number stream is envisaged to be kept in operation. However under emergency situation, both the streams may be kept under simultaneous operation.

From the Dual Media Filters, filtered water pass through the Activated Carbon Filters, Activated Carbon Filters remove the residual chlorine, present in the water.

The filtered water from Activated Carbon Filters enters to Weakly Acidic Cation Exchangers and then Strongly Acidic Cation Exchangers where the resin exchanges hydrogen ions with other cations. The treated water from Strongly Acidic Cation Exchangers thus contains acids of chloride, sulphate, bicarbonate etc. This water is then led into Degasser Towers where it enters at the top.

Weakly Acidic Cation Exchangers will be regenerated in co-current and thoroughfare mode with Strongly Acidic Cation Exchangers. On exhaustion, a Strongly Acidic Cation Exchanger is regenerated in counter current mode with hydrochloric acid...

The Degasser Tower is a packed column and air is blown from the bottom by Degasser Air Blowers. Here the unstable carbonic acid is stripped into carbon di-oxide and water. Carbon di-oxide is vented out. Water from Degasser Tower is collected to the Degassed Water Storage Tank by gravity.

Degassed water from Degassed Water Storage Tank is pumped to the Weakly Basic Anion Exchangers Resins of Weakly Basic Anion Exchangers

exchange anion of strong acids with hydroxyl ions. The Water then enters to the Strongly Basic Anion Exchangers for further exchange of anions.

Resins in Strongly Basic Anion Exchangers exchange remaining chloride, carbon-di-oxide, silica etc. with hydroxyl ions. The water then enters into the Mixed Bed Exchangers.

Weakly Basic Anion Exchanger will be regenerated in co-current and thoroughfare mode with Strongly Basic Anion Exchanger. On exhaustion, Strongly Basic Anion Exchanger is regenerated in counter current mode with sodium hydroxide.

Hot Water Tank with electrical heating arrangement is provided for heating the power water used for regeneration of strongly basic anion resins. This is to ensure the regeneration at elevated temperature for complete elution of silica from the resin bed.

Facility for Alkaline Brine Rejuvenation has been envisaged for removal of organic matter from the strongly basic anion resin bed.

The Mixed Bed Exchanger contains both strongly acidic cation and strongly basic anion resins. Any slip of cations/anions are exchanged and removed in Mixed Bed Exchanger, which acts as polisher. The demineralized water, thus produced is stored in DM Water Storage Tank.

On exhaustion, Mixed Bed Exchanger is regenerated using hydrochloric acid and sodium hydroxide.

Regeneration waste from DM system shall be led to the Neutralization Pit for further disposal. The regeneration waste of DM System shall be generally self neutralizing. It consists of two compartments. Once a compartment gets full, the Neutralized Waste Disposal Pumps are started and kept in recirculation mode. pH of the effluent is measured and acid/alkali is added as required. The blowers are run to mix the added chemicals. Once the pH value become in the acceptable range, the neutralized effluent is disposed to Central Monitoring Basin.

The regeneration facilities as envisaged for Ion Exchange Units are as follows:

- a) Acid Unloading System through Pumps, Acid Storage Tanks and Measuring Tanks etc. for regeneration of Cation Resins.
- b) Alkali Unloading System through Pumps, Caustic Storage Tanks, Measuring Tanks, etc. for regeneration of Anion Resins.

All regeneration wastes and other drainages from Ion Exchange Units are led to Neutralisation Pit, each compartment of which shall be capable to hold regeneration effluent generated from One (1) complete chain plus 20% margin.

2.00.00 SCOPE OF SUPPLY AND SERVICES

The equipment and accessories to be furnished and put into operation and all other required services are detailed herein under. The items, though not specifically mentioned but needed to make the system complete in all respects

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- and reliable for safe and smooth operation and guaranteed performance, shall also be treated as though included and the same shall be furnished, unless otherwise specifically excluded elsewhere.
- 2.01.00 Two (2) numbers Activated Carbon Filters, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.02.00 Two (2) numbers Weakly Acidic Cation Exchangers, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.03.00 Two (2) numbers Strongly Acidic Cation Exchangers, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.04.00 Two (2) numbers forced draft Degasser Towers [One (1) number on each Degassed Water Storage Tank], each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.05.00 Three (3) numbers Degasser Blowers, each complete with electrical drive motor and all other accessories as required.
- 2.06.00 Two (2) numbers Degassed Water Storage Tanks, each complete with integral pipe works, valves and all other accessories as required.
- 2.07.00 Three (3) numbers Degassed Water Transfer Pumps, each complete with electrical drive motor and all other accessories as required.
- 2.08.00 Two (2) numbers Weakly Basic Anion Exchangers, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.09.00 Two (2) numbers Strongly Basic Anion Exchangers, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.10.00 Two (2) numbers Mixed Bed Exchanger s, each complete with internals, integral pipe works, valves and all other accessories as required.
- 2.11.00 Two (2) numbers Air Blowers for Mixed Bed Exchangers (common for Neutralization Pit), each complete with electrical drive motor, suction filters, suction & discharge silencers, relief valve and all other accessories as required.
- 2.12.00 Two (2) numbers hose stations for unloading Hydrochloric Acid. The hose station shall have two (2) Numbers 80 mm NB rubber hose connection.
- 2.13.00 Two (2) numbers Hydrochloric Acid Unloading Pumps each complete with electrical drive motor and all other accessories as required.
- 2.14.00 Two (2) numbers Hydrochloric Acid Storage Tanks each complete with integral pipe works, valves and all other accessories as required.
- 2.15.00 Two (2) numbers Hydrochloric Acid Measuring Tanks for Cation Exchangers, complete with integral pipe works, valves and all other accessories as required.
- 2.16.00 One (1) number Hydrochloric Acid Measuring Tank for Mixed Bed Exchangers, complete with integral pipe works, valves and all other accessories as required.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

2.17.00	Two (2) numbers hose stations for unloading Caustic. The hose station shall have two (2) numbers 80 mm NB rubber hose connection.
2.18.00	Two (2) numbers Caustic Unloading Pumps, each complete with electrical drive motor and all other accessories as required.
2.19.00	One (1) number Activated Carbon Filter for caustic, complete with internals, integral pipe works, valves and all other accessories as required.
2.20.00	Two (2) number Caustic Storage Tanks, each complete with integral pipe works, valves and all other accessories as required.
2.21.00	Two (2) numbers Caustic Measuring Tanks for Anion Exchangers, complete with integral pipe works, valves and all other accessories as required.
2.22.00	One (1) number Caustic Measuring Tank for Mixed Bed Exchangers, complete with integral pipe works, valves and all other accessories as required.
2.23.00	One (1) number Brine Preparation Tank, complete with integral pipe works, valves and all other accessories as required.
2.24.00	One (1) number Regeneration Water Heater for regeneration of anion resins, complete with integral pipe works, valves and all other accessories as required.
2.25.00	Two (2) numbers Regeneration Water Pumps, each complete with electrical drive motor and all other accessories as required.
2.26.00	One (1) number Acid Measuring Tank for neutralization, complete with integral pipe works, valves and all other accessories as required.
2.27.00	One (1) number Caustic Measuring Tank for neutralization, complete with integral pipe works, valves and all other accessories as required.
2.28.00	One (1) number Neutralization Pit (with two compartments), complete with integral pipe works, valves and all other accessories as required.
2.29.00	Two (2) numbers Neutralized Effluent Disposal Pumps, each complete with electrical drive motor and all other accessories as required.
2.30.00	Two (2) numbers safety showers near acid/ caustic storage tanks.
2.31.00	One (1) number Central Sampling Rack (to be located at Express Laboratory to be located at ground floor of DM Plant Building)
2.32.00	First fill of filter media, resins, and degasser tower packings for all the units complete with make-up filter media, resin and packings for first three years of operation. Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively. For filter make-up a loss of 10% per annum shall be considered.
2.33.00	All consumables, bulk chemicals like hydrochloric acid etc., required for pre commissioning, PG test till taking over along with topping up required for 3 months of operation shall be in the scope of the Bidder.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 2.34.00 All integral and interconnected pipe works, valves, strainers, pressure relief valves, instrument stubs, specialties, sumps, gates, all types of pipe supports, pipe racks, pipe bridges etc. for the entire system.
- 2.35.00 Supply and application of shop painting and final painting at manufacturer's works and at site for the entire system as specified elsewhere in Volume III-C of this Bid Document.
- 2.36.00 All instrumentations and controls complete with accessories as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
- 2.37.00 All electrical equipment and accessories as required for this system shall be supplied. These equipment and accessories shall meet the technical requirements of individual equipment specification covered under "Electrical Equipment & Accessories - Volume -V" of this Bid Document.
- 2.38.00 All civil as well as structural design, construction and architectural works as addressed in General Specification and Design Criteria for Civil and Structural Work - Volume -VII / A, General Specification and Design Criteria for Architectural Work - Volume - VII / B & Technical Specification for Civil, Structural and Architectural Work – Volume- VII / C of this Bid Document.
- 2.39.00 All equipment and accessories as addressed in Specifications for Ventilation and Air Conditioning System - Volume III-D of this Bid Document.
- 2.40.00 All consumables (lubricating oil, inhibitor for oil), mandatory spares, recommended spares, spares required for erection and commissioning of complete system, new set of special tools and tackles, fixtures etc. required for regular operation and maintenance of the system as addressed in Lead Specification - Volume II-A of this Bid Document.
- 2.41.00 Services included under this Specification**
- All services as addressed in Lead Specification - Volume II-A of this Bid Document need to be considered as included with reference to Demineralization System, under the scope of Specification:
- 3.00.00 EXCLUSIONS**
- Following items shall be considered as excluded from the scope:
- 3.01.00 Supply of river water.
- 3.02.00 Supply of construction water and construction power.
- 3.03.00 For exclusions with reference to electrical equipment and accessories, Bidder may please refer to Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.
- 3.04.00 For exclusions with reference to civil as well as structural design, construction and architectural works, Bidder may please refer to General Specification and Design Criteria for Civil and Structural Work - Volume -VII/A, General Specification and Design Criteria for Architectural Work - Volume -VII/B & Technical Specification for Civil, Structural and Architectural Work - Volume –

DEVELOPMENT CONSULTANTS

(e-PCT-TS-K-02-2014-15 -V-III-C-Sec-II DM.doc)

V.III-C/S-II: 5

VII/C of this Bid Document.

4.00.00 INTERFACE POINTS

Not Applicable.

5.00.00 SALIENT DESIGN FEATURES

5.01.00 The clarified water analysis to be adopted for the design of DM System has been furnished in Annexure-I enclosed along with this document.

5.02.00 Design qualities of treated water from various Units of DM System as envisaged have been described elsewhere in this specification.

5.03.00 Ion Exchange Resin

- a) Resins shall be of reputed make and must have been in use in demineralising systems capable of producing water as specified or better.
- b) The resin charge shall consist of material properly selected, washed, processed and graded to provide the guaranteed capacity and life, and shall have adequate resistance to attrition losses during its guaranteed quality output life.
- b) The resin shall be insoluble in acids, alkalis or common solvents. The resin shall be able to withstand a temperature of 60 degree C minimum.
- c) All Resins shall be supplied in manufacture's own sealed containers. No broken drum/containers or loose packing for resins will be accepted.
- d) The Bidder shall provide all details and calculations, inclusive of resin characteristic curves marked-up with duty/design points etc., as back-up with reference to selection of at regeneration levels, designed resin quantities, quality of treated water etc. The Bidder should consider 10% (minimum) deration over the corrected exchange capacity, obtained from the published manufacturer's resin literatures to arrive at operating exchange capacities for different kinds of resins.
- e) The cation resins for Weakly Acidic Cation Exchangers shall have cross linked polyacrylic matrix with carboxylic acid as functional group. The same shall be suitable for thorough-fare and co-current regeneration.

The cation resins for Strongly Acidic Cation Exchangers shall have styrene-divinyl benzene matrix with sulphonates as functional group.

The same shall be suitable for counter current regeneration.

The attrition loss of the cation resins shall be guaranteed not to exceed three (3) percent per year for the five (5) years of operation.

Suitable regeneration levels and resin quantities for Weakly Acidic Cation Exchangers and Strongly Acidic Cation Exchangers shall be selected to ensure minimum leakage of cations as specified elsewhere in this specification.

- f) The anion resins for Weakly Basic Anion Exchangers shall have macro-porous cross linked polystyrene matrix with tertiary amine (minimum 90%) as functional group. The same shall be suitable for thorough-fare and co-current regeneration.

The anion resins for Strongly Basic Anion Exchangers shall be Type-I and have macro-porous styrene-divinyl benzene matrix with quaternary ammonium (minimum 95%) type functional group. The same shall be suitable for counter current regeneration.

The attrition loss of the anion resins shall be guaranteed not to exceed five (5) percent per year for the first five (5) years of operation.

Suitable regeneration levels and resin quantities for Weakly Basic Anion Exchangers and Strongly Basic Anion Exchangers shall be selected to ensure minimum leakage of anions and silica as specified elsewhere in this specification.

- 5.04.00 The type of mixed bed cation & anion resins shall be as described above for Strongly Acidic Cation and Strongly Basic Anion Exchangers. The resins shall be suitable for co-current / counter-current regeneration.
- 5.05.00 The physical and chemical properties of ion exchange resins shall be tested by the methods as specified in IS: 7330.
- 5.06.00 For the regeneration of weak and strong cation exchanger units, power water used shall be degassed water.
- 5.07.00 For the regeneration of weakly/ Strongly Basic Anion Exchangers and Mixed Bed Exchangers, power water used shall be demineralized water.
- 5.08.00 Cation resin of DM System shall be regenerated by hydrochloric acid (30-33% w/v) and anion resins by sodium hydroxide available in lye (40-48% w/v) form. All chemicals shall be as per the requirements of technical grade as per relevant IS.
- 5.09.00 The total time of regeneration of a DM Stream (Activated Carbon Filter, Weakly Acidic Cation Exchanger, Strongly Acidic Cation Exchanger, Weakly Basic Anion Exchanger and Strongly Basic Anion Exchanger) except the Mixed Bed Exchanger shall not exceed four (4) hours.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 5.10.00 The total time of regeneration of a complete DM Stream (Activated Carbon Filter, Weakly Acidic Cation Exchanger, Strongly Acidic Cation Exchanger, Weakly Basic Anion Exchanger, Strongly Basic Anion Exchanger and Mixed Bed Exchanger Unit) shall not exceed six (6) hours.
- 5.11.00 Counter-current regeneration for Strongly Acidic Cation Exchangers and Strongly Basic Anion Exchangers shall be adopted. For Weakly Acidic Cation , Weakly Basic Anion Exchangers , regeneration may be co-current. For MB Exchangers, regeneration may be co-current / counter-current.
- 5.12.00 Regeneration level in Strongly Acidic Cation and Strongly Basic Anion in DM system to be so adopted that the resultant effluent become self neutralizing. Moreover the regeneration effluent from MB Unit shall individually be self neutralizing in nature.
- 5.13.00 Regeneration levels in Strongly Acidic Cation and Strongly Basic Anion Exchanger shall be so adopted such that regeneration waste generated from cation and anion exchangers of a DM stream is self neutralized in nature.
- 5.14.00 Regeneration levels in MB Exchanger shall be so adopted such that that regeneration acidic and alkaline waste from MB Exchanger of a DM stream is self neutralizing in nature.
- 5.15.00 A min. of 300 mm freeboard shall be provided for all the atmospheric tanks.
- 5.16.00 Under drain system shall be either header lateral or strainer on plate type. In case of header lateral system, no subfill shall be used which may come in contact with water. In case of strainer on plate type design, an additional manhole shall be provided to give access below the bed plate.
- 5.17.00 For calculations of anion exchange capacity and silica leakage, the temperature of alkali for regeneration should be taken as 25 degree C for regeneration of Strongly Basic Anion Exchanger only.
- 5.18.00 The regeneration level, resin quantity, treated water quality and chemical consumption for the Weakly Basic Anion and Strongly Basic Anion Exchangers shall be designed, selected and guaranteed based on regeneration of the same at ambient temperature i.e. 25 degree C. However, all ion exchangers, degassifying tower and filters shall be designed for inlet water temperature of 10 degree C.
- 5.19.00 Further specific salient design features of major equipment and accessories have been furnished under Annexure- II
 In addition to above, required general technical features for Pressure Vessels, Storage Vessels, Piping, Fittings, Valves, Miscellaneous Pumps, Protective Lining, Painting, Mechanical Erection, Testing and Commissioning have been addressed under Sections VII to XIV as attached elsewhere in Volume III-C of this Bid Document.
- 6.00.00 **OPERATION AND CONTROL PHILOSOPHY**
- 6.01.00 DM system shall be controlled and monitored from PLC based control system

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

(DM PLC) through PC based workstations located in Control Room inside Demineralization System Building and 2 nos. LVS provided.

6.02.00 The basic mode of operation of Demineralization System is envisaged to be semi- automatic and sequential mode in nature Potable Water Treatment system shall also be controlled & monitored from the DM PLC. DM PLC shall be connected to the common BOP network for remote operation / monitoring from CCR. BOP network shall be interfaced with DDCMIS through soft links. 1 no OWS shall be placed in CCR control room in TG building for monitoring purpose of shift charge engineer.

6.03.00 Filters/Ion exchange units will be automatically isolated from the system under the conditions as follows:

Activated Carbon Filter	:	On output of predetermined volume of treated water or high differential pressure across the filter bed, whichever occurs first
Weakly Acidic Cation Exchanger	:	On output of predetermined volume of treated water
Strongly Acidic Cation Exchanger	:	On output of predetermined volume of treated water or high sodium leakage, whichever occurs first.
Weakly Basic Anion Exchanger	:	On output of predetermined volume of treated water
Strongly Basic Anion Exchanger	:	On output of predetermined volume of treated water or abnormal pH or high conductivity or high silica, whichever occurs first.
Mixed Bed Exchanger	:	On output of predetermined volume of treated water or abnormal pH or high conductivity or high silica, whichever occurs first.

6.04.00 On exhaustion, the particular filter/exchanger will be completely isolated from the system automatically and an alarm status be displayed on the Operator's station.

6.05.00 The operator will initiate the operation of backwashing /regeneration/rinsing/ of a particular filter /ion-exchange unit, and the change from one step of the sequence to the next will be automatic. The system will employ a logical system, which will link the various steps such as closing/opening of different valves, starting/stopping of various pumps, which make a sequence. The logical system will adhere to the correct sequence of operation and the pre-determined (adjustable) time-intervals. The system will be interlocked so that the necessary pre-requisite for each step, are completed prior to proceeding to the next step. The automatic sequence of operations shall be interruptible at any time by the operator and operator shall be able to take over the control to manual from that step onwards.

6.06.00 During regeneration, the progress of different sequence/sub-process shall be displayed to the operator in the form of step description, which is in progress, the set time for that step, the elapsed time for that step, etc. Failure in any operation will also be indicated.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 6.07.00 It shall be possible for the operator to extend the time of a particular step. The timer will restart once the operator puts back the system in auto and the other steps will then follow as programmed. The progress of the sequence shall be displayed to the operator. The system will incorporate the necessary safety systems, locking systems and manual emergency system. On failure of logic system in between, the failure shall be displayed to the operator and the valves corresponding to that unit, being regenerated will automatically open or close as required.
- 6.08.00 Once a filter/exchanger has been backwashed/regenerated it will not be put back into service automatically, but operator will have to manually put back into service through a Selection Key.
- 6.9.00 Apart from complete automatic regeneration which includes fixed time rinsing facility, separate rinsing facility shall also be provided for each of the exchanger units to carry out rinsing remote manually, which will be required in cases:
- i) When a regenerated unit had been off the service for quite some time.
 - ii) When additional rinsing during the regeneration operation apart from the fixed programmed rinsing of automatic regeneration process is required to be carried out.
- 6.10.00 During automatic progress of the sequence the opening and closing of different valves shall also be indicated to the operator. The pumps which will be under operation in course of regeneration, need to be interlocked with reference to the required parameters for safe regeneration. To provide additional manual over-ride facility for individual type of filter or exchanger, each of them shall be provided with "Auto-Off-Manual" Key. Automatic sequential operations shall be carried out with individual A/M Key in Auto position only.
- 6.11.00 However, A/M keys in "Manual" position shall permit over riding facility for respective unit through "Service-Off-Regeneration-Off-Extra Rinse-Off" key provided for each filter/ ion-exchanger unit and another Multi Position Manual Regeneration Key common for particular type of filter/exchanger. For cation and anion exchangers a separate key shall be provided for backwash, which is an optional step in a regeneration sequence. A "Double Regeneration Key" shall also be provided for these exchangers. Indication on Operator's station display shall be there for each step of "Service-Off-Regeneration-Off-Extra Rinse-Off" Selection Key.
- 6.12.00 All the above functions shall be carried out by A/M Keys and Selection Keys pertinent to interlock & sequence logic.
- 6.13.00 The options in Operator Station display unit as described hereinafter shall be provided as minimum:
- a) Auto-Manual Selection Keys for each filter/exchanger.
 - b) Auto-Manual Selection Keys for all drives.
 - c) Tank selection, drive selection, valve selection etc. as required.
 - d) Regeneration Advance, Hold, Hold Reset, Stop, Skip, etc.
- 6.14.00 A separate graphic depicting the complete process operations shall be provided in LCD monitor. This graphic on monitor shall indicate the different

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- filters, exchanger units, measuring tanks, opening / closing of different valves, ON/OFF status of different pumps and blowers, etc. Colour coding shall be used to differentiate lines for different services, such as, service water line, backwash lines, acid/alkali lines, etc.
- 6.15.00 Quality parameters, such as pH, conductivity, Silica etc. and, level and flow rate shall also be displayed on the LCD monitor.
- 6.16.00 Pneumatically operated valves will be installed at inlet, outlet, back wash, regeneration and rinse line of each filter, ion-exchange units etc. The valves will be closed or opened, as required, in automatic cycles by PLC. Pneumatic operated valves not connected with semi-automatic regeneration system, shall have individual open/ close Selection Key at monitor.
- 6.17.00 Air Vent valve of all filters/exchangers shall have open/close Selection Key at monitor. This shall also be connected to PLC.
- 6.18.00 All on-off type control valves shall be diaphragm type with diaphragm actuator. The valves shall be provided along with the accessories like air filter regulator, air lock relay, position transmitter as applicable & detailed elsewhere in this specification and shall have facility for operation from housing itself.
- 6.19.00 All bleed valves coming on backwash water line and regenerant chemical line, and also air vent valve of each filters / exchanger vessels will be "Spring to Open - Air to Close" type. The valves coming on inlet and outlet lines of filters / exchanger units, regenerant chemical inlet lines and all other lines except those mentioned above shall be "Spring to Close - Air to Open" type. The pump recirculation valve will however be "Spring to Open - Air to Close" type. Solenoid valves for all "Spring to Open - Air to Close" type valves shall be de-energized to open while those for "Spring to Close - Air to Open" valves shall be energized to open. The valves will be closed or opened, as required, in automatic cycles.
- 6.20.00 All actuators shall be slow acting type to prevent water hammer in the system and pipeline. Each auto-valve shall have limit switch for indication of opening and closing status in the LCD monitor.
- 6.21.00 All pneumatic/motor-operated valves shall also have local device for emergency local manual operation.
- 6.22.00 All pumps, discharge valves of all pumps, pneumatic valves, drive motors, shall have facility for remote manual operation from Operator's Station LCD. Fail safe operation shall be ensured. Specially when power failed and power restored times, and air failure/air restoration times all the valves in total system shall go to fail safe mode so that the water already available in system shall not be contaminated.
- 6.23.00 Solenoid valves shall be mounted in the racks of the local panels. The valves shall be provided with all accessories such as isolating cocks, filters, air supply headers as required & detailed elsewhere in this specification. and shall have facility for operation from rack itself. Name plates with tag number shall be provided for each and every valve.
- 6.24.00 Separate conductivity cells shall be employed for measuring the conductivity in

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

the service outlet and in the rinse line of ion exchanger units for normal and rinsing operation. The cell in the rinsing line shall be automatically isolated during the first half of the rinsing cycle and shall be connected automatically during the second half of rinsing cycle when the conductivity is less than 100 micromhos / cm excess over the rinse water conductivity.

6.25.00 All drive motors shall be provided with arrangement of local starting and stopping. Local starting shall be possible through remote/local Selection facility in MCC. Tripping of drive motors from local Push-Button stations shall be permissible irrespective of the position of remote/local Selection facility. Local Stop Push-Button shall be locked after tripping the motor from local. All pumps and blowers shall also be provided with Auto-off-Manual Selection Key except Transfer pumps. All motors, valves, etc. shall be connected to PLC and all the above functions described above shall be performed (even local operation as required) in PLC except the drives as enlisted below:

- a) Transfer pumps – No PLC operation.
- b) A/C and Ventilation System – fans, pumps and other drives – No PLC operation.

6.26.00 Although the basic operation of Demineralization System is semi- automatic in nature, following operations shall be performed manually.

- a) Transfer of Acid
 - i) Hydrochloric acid will be unloaded from the road tank-cars by operation of any one of the Acid Transfer Pumps and will be stored in Acid Storage Tanks. Operation shall be controlled from local panel.
 - ii) Hydrochloric acid, stored in tanks, will be led remote manually or by automatic sequence by gravity to the Acid Measuring Tanks for cation, mixed bed units to fill up to the desired level. Necessary tank selection key shall be provided in Operator Station display unit. Subsequent transfer of acid from the Measuring Tanks to the Ion-Exchanger Units as required in regeneration operation is however automatic.
- b) Transfer of Alkali
 - i) Sodium hydroxide in lye form shall be unloaded from road tank cars by operation of one of the Alkali Transfer Pumps and will be stored in Alkali Storage Tank. Operation shall be controlled from local panel.
 - ii) Transfer of alkali from Storage Tanks to the respective Measuring Tanks for Anion and Mixed Bed Exchanger Units will be done remote manually or by automatic sequence by gravity. Necessary Selection key shall be provided for this in Operator Station display. However, subsequent transfer of alkali to respective Ion Exchanger Units will be automatic.
- c) Neutralization of Waste from DM System

- i) After completion of regeneration the waste generated during regenerations will be thoroughly recirculated in the neutralization pit and if necessary acid/alkali will be added to make the pH of waste within permissible range.
- ii) When required pH of waste solution has been reached, the waste solution will be disposed to Waste Water Treatment system. The pump will automatically be tripped when the level in neutralization pit reaches very low.

7.00.00 **QUALITY CONTROL & SURVEILLANCE**

With reference to requirements and stipulations for Quality Assurance, Bidder may please refer to Lead Specification - Volume II-A of this Bid Document.

8.00.00 **INSPECTION, TESTING AND COMMISSIONING, PERFORMANCE GUARANTEE**

8.01.00 **Shop Tests**

Shop tests shall include all tests to be carried out at Bidder's works, works of their sub-vendors and at works where materials to be used for fabrication of equipment are manufactured. The tests to be carried out shall include but not be limited to the following:

- a) Composition of all material, castings, forgings, etc.
- b) Hydraulic tests for pressure vessels, pipes, valves, pump casing etc.
- c) Tests to check faults in protective lining and painting.
- d) Static balancing test for agitators, stirrers, paddles etc.
- e) Static and dynamic balancing tests on all impellers.
- f) Performance tests (Head, Capacity and Power) for each of pumps and blowers.
- g) Tests for physical and chemical characteristics of activated carbon and ion exchange resins.
- h) All tests with reference to instrumentations and controls complete with accessories as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
- i) All tests with reference to electrical equipment and accessories as addressed in Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.

8.02.00 **Tests before Trial Run**

Bidder shall carry out tests at site to prove to the Purchaser that individual equipment of all the System complies with the requirements stipulated and is erected in accordance with requirements specified. Before the System is put on trial run, the Bidder will be required to conduct tests to demonstrate to the Purchaser that each individual item is capable of correctly performing the functions for which it has been designed for. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows:

- a) The tests to be carried out for the fabricated storage vessels shall include:
 - i. During fabrication and before lining:
 - a) Bottom testing for leakage by soap solution, after the bottom and at least the bottom course of the shell plate have been welded.
 - b) Hydraulic shell testing for leakage.
 - c) Fixed roof test for leakage by soap solution.
 - ii. After lining:

Water leakage test for storage tank shall be carried out by filling it with water up to the overflow level.
- b) All piping and valves, after installation, will be tested hydrostatically at one and half times of the maximum attainable pressure in the system to check against leak tightness.
- c) All valves/isolation gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.
- d) Each of all pumps and blowers shall be run with the specified fluid from shut off condition to valve wide-open condition. Head developed will be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicator where available. Otherwise capacity shall be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) wherever applicable and duration of test.
- e) Each of pumps and blowers shall be tested at site to run smoothly without undue vibration, flow pulsation, temperature rise in bearing parts, noise etc.
- f) Each of all the agitators and other rotating/moving devices shall be run at the rated speed with water/chemicals up to the normal water level for a period of twenty four (24) hours. During this period all the components shall function smoothly without any unbalance, vibration, overheating at bearing parts etc.
- g) All the rubber lining are to be subjected to the following tests as per relevant code:

- i. Adhesion test
- ii. Resistance to bleeding
- iii. Thickness measurement
- iv. Shore hardness
- v. High voltage spark test
- h) Epoxy painting shall be checked by dry type thickness gauge.
- i) All monorail hoists shall be subjected to full working load during all motions without showing any sign of defect.
- j) Visual check on all structural components, welding, painting etc.
- j) All tests with reference to instrumentations and controls complete with accessories as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
- k) All tests with reference to electrical equipment and accessories as addressed in Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.

8.03.00**Performance Guarantee Test Procedure for DM System**

- a) Necessary pumps shall be started and flow shall be established through all the streams. Valves shall be adjusted so as to have equal and rated distribution of flow through all the streams.
- b) One (1) stream shall be running at a time. Samples of water will be drawn every hour from the outlet of Activated Carbon Filter, Weakly Acidic Cation Exchanger, Strongly Acidic Cation Exchanger, Degasified Water Storage Tank, Weakly Basic Anion Exchanger, Strongly Basic Anion Exchanger and Mixed Bed Exchanger and then tested in the laboratory. The results shall be compared against the required parameters stipulated elsewhere under this specification.
- c) Exhaustion of each Unit shall be indicated by the features described under Operation and Control Philosophy for Demineralization System. Units shall then be backwashed / regenerated at the specified regeneration level. Total amount of chemicals required for regeneration and the duration of chemical injection /regeneration of each Ion Exchange Unit shall be noted against the guaranteed figures.
- d) The regenerated stream shall be again put into service and tests in item will be continued. At the end of run (as determined in above, total amount of water treated will be noted from the flow integrators.
- e) Inlet water analysis is determined by making arithmetic average of all hourly readings of clarified water taken during the test.
- f) Based on this inlet water analysis, regeneration level employed, resin volume provided and characteristic curves of the resins employed, the capacity of each stream in terms of total volume of treated water (m^3)

between two (2) successive regenerations shall be calculated. Resin volume shall not include the buffer and inert layers provided. The calculation shall be approved by the Purchaser / Engineer.

- g) Quantity of treated water as determined by tests as in above shall be checked against calculated quantity of treated water during regeneration as in above and must be equal to or more than the calculated amount.
- h) All the above mentioned tests shall be separately done for each of the streams of the complete DM System.

8.04.00 **Performance Guarantee parameters for Demineralization System**

- a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.
- b) All blowers shall be guaranteed for head and power consumption.
- c) Activated Carbon Filter
 - i) Each Activated Carbon Filter will have a rated continuous treated water output capacity of not less than 60 m³/hr (net) over and above the quantity of treated water required for backwash / regeneration / rinse of itself and other units of the same stream or chain it belongs to. It shall be backwashed once after every 18 hours of continuous service run.
 - ii) Free chlorine content of treated water shall be nil.
- d) Ion Exchange Units
 - i) Each Ion Exchange Unit will have a rated continuous treated water output capacity of not less than 60 m³/hr (net) over and above the quantity of treated water required for backwash / regeneration / rinse of itself and other units of the same stream or chain it belongs to. Except Mixed Bed Units, each Ion Exchange Unit shall be regenerated once after every 18 hours of continuous service run. Each Mixed Bed Unit shall be regenerated once after every 126 hours of continuous service run.
 - ii) Net output from each of Weakly Acidic Cation Exchanger Unit, Strongly Acidic Cation Exchanger Unit, Weakly Basic Anion Exchanger Unit, Strongly Basic Anion Exchanger Unit between two regeneration shall be not less than 1080 m³ of treated water and that for each of Mixed Bed Exchanger Unit shall be not less than 7560 m³ of treated water for the design water analysis as exhibited in Annexure-I. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this Specification and guarantee shall be applicable on this calculated quantity.

- iii) Chemical consumption of the ion exchange units as indicated by the Bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance.

The guaranteed values of chemical consumption shall hold good for chemicals conforming to following specification :

- i) Hydrochloric Acid IS-265 (Tech Grade)
 - ii) Sodium Hydroxide IS-252 (Rayon grade available in Flakes)
- iv) The total time for backwash (as applicable) and regeneration of a stream of Demineralization System Stream (for Activated Carbon Filter - Weakly Acidic Cation Exchanger - Strongly Acidic Cation Exchanger - Weakly Basic Anion Exchanger - Strongly Basic Anion Exchanger) except the Mixed Bed Exchanger shall not exceed 4 hours.
- v) The total time for complete backwash (as applicable) and regeneration of a stream of Demineralization System Stream and (for Activated Carbon Filter - Weakly Acidic Cation Exchanger - Strongly Acidic Cation Exchanger - Weakly Basic Anion Exchanger - Strongly Basic Anion Exchanger - Mixed Bed Exchanger) shall not exceed 6 hours.
- vi) Qualities of treated water from various units are envisaged as follows:

Water Quality at the outlet of MB Exchanger:

Total Electrolyte	0.1 ppm, max.
Total SiO ₂	0.01 ppm SiO ₂ , max.
Iron as Fe	Nil
Free CARBON DI-OXIDE ppm as Nil	
CARBON DI-OXIDE	
Total Hardness	Nil
pH value at 25 ⁰ C	6.8 - 7.2
Conductivity, micro mho/cm	< 0.1 at 25 ⁰ C

Water Quality at the outlet of Strongly Basic Anion Exchanger:

SiO ₂	<0.1 ppm as SiO ₂
Conductivity, micro mho/cm	< 5.0 at 25 ⁰ C

Water Quality at the outlet of Degasser Tower:

CARBON DI-OXIDE content	< 5 ppm as Carbon Di-Oxide.

Water Quality at the outlet of Strongly Acidic Cation Exchanger:

Sodium	<1.0 ppm as CaCO ₃
Hardness	Not Detectable

9.00.00 BID EVALUATION CRITERIA

With reference to Bid Evaluation Criteria, Bidder may please refer to Lead Specification - Volume I of this Bid Document.

10.00.00 PERFORMANCE GUARANTEE TOLERANCE AND PENALTY
10.01.00 Liquidated Damages (LD) for Additional Power Consumption

With reference to Additional Power Consumption, Bidder may please refer to Lead Specification - Volume II-A of this Bid Document.

10.02.00 Liquidate Damages (LD) for Non Achievement of Specific Performance:

The performance Guarantee parameters for Demineralisation System have been indicated elsewhere in this specification.

No negative tolerance in respect flow, head and other performance guarantee parameters are acceptable to the Purchaser. In case, any equipment of Demineralisation System is not able to achieve the performance guarantee parameters during the Performance Guarantee Tests, Bidder shall make necessary modifications or replace the Equipment/ Plant or any part within three months period from the date of conducting PG test. If even after rectification, the Equipment/Plant is not able to achieve the guaranteed performance parameters, the Purchaser shall have right to reject the Equipment/Plant. In such case, the Bidder shall pay back the total amount paid to them with reference to the Equipment/Plant (with all taxes and duties as applicable) to the Purchaser.

10.03.00 LIQUIDATED DAMAGES FOR DELAY IN DELIVERY & COMMISSIONING
10.04.00 With reference to Liquidated Damages for Delay in Delivery & Commissioning , Bidder may please refer to Conditions of Contract - Volume I of this Bid Document.
11.00.00 SPARES

With reference to Spares, Bidder may please refer to Lead Specification - Volume II-A of this Bid Document.

12.00.00 TOOLS & TACKLES

With reference to Tools and Tackles, Bidder may please refer to Lead Specification - Volume II-A of this Bid Document.

13.00.00 DRAWINGS / DOCUMENTS TO BE FURNISHED BY THE BIDDER

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- The Bidder's formal proposal must be accompanied by the following Documents/Drawings/Information:
- 13.01.00 All the details as addressed under Bid Proposal Sheets under Schedule-IX-B of Volume-IX of the EPC Bid Document.
 - 13.02.00 Process and Instrumentation Diagram for the complete system.
 - 13.03.00 Dimensional General Arrangement Drawing for the complete system.
 - 13.04.00 Electrical Load List for the complete system.
 - 13.05.00 Schedule of terminal points and their characteristics.
 - 13.06.00 Quality assurance plan.
 - 13.07.00 Requirement of construction power & water with the required characteristics, quantum etc.
 - 13.08.00 Experience list addressing the details complete with the locations where Bidder have supplied and commissioned similar systems for similar application under similar duty conditions as specified under this EPC Bid Document.
 - 13.09.00 List of imported items, if any.
 - 13.10.00 List of proposed Sub-Vendors.
 - 13.11.00 In case Bidder is offering equipment/plant/test procedures as per International Standards not mentioned specifically in the Bid Documents, he should furnish at least three (3) copies of English Version of the same along with the offer, for consideration.
 - 13.12.00 All Documents/Drawings/Information as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
 - 13.13.00 All Documents/Drawings/Information as addressed in Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.
 - 13.14.00 All Documents/Drawings/Information as addressed in General Specification and Design Criteria for Civil and Structural Work - Volume -VII/A, General Specification and Design Criteria for Architectural Work - Volume -VII/B & Technical Specification for Civil, Structural and Architectural Work - Volume -VII/C of this Bid Document.
 - 13.15.00 All Documents/Drawings/Information as addressed in Specifications for Ventilation and Air Conditioning System - Volume III-D of this Bid Document.
 - 14.00.00 **DRAWINGS / DOCUMENTS TO BE FURNISHED AFTER AWARD OF CONTRACT**

The Bidder need to comply with all Documents/Drawings/Information already furnished in their Bid and subsequent correspondences/clarifications if any till the date of issue of notice of award of Contract. Revision of any data must

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

meet the approval of the Purchaser.

Requirements of Documents/Drawings/Information (not limited to) from the successful Bidder after finalization of contract in respect of individual equipment as well as the complete system covered under the specification are furnished below:

Requirements of Documents/Drawings/Information under 'Approval' category

14.01.00	Process Design Calculations, Mechanical Design Calculations (Sizing Calculations for each equipment, miscellaneous Hydraulic Calculations, miscellaneous Pressure Drop Calculations, miscellaneous Thickness Calculations, etc).
14.02.00	Process and Instrumentation Diagram for the entire system complete with all kinds of details.
14.03.00	Dimensional General Arrangement Drawing for the entire system complete with all kinds of applicable details.
14.04.00	Dimensional General Arrangement and Cross Sectional Drawing for each of all major equipment and each of all buildings complete with all kinds of applicable details.
14.05.00	Indoor and Outdoor Piping Layout with suitable sectional views for the complete system.
14.06.00	Procedures for Performance Guarantee Tests.
14.07.00	All Documents/Drawings/Information as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
14.08.00	All Documents/Drawings/Information as addressed in Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.
14.09.00	All Documents/Drawings/Information as addressed in General Specification and Design Criteria for Civil and Structural Work - Volume -VII/A, General Specification and Design Criteria for Architectural Work - Volume -VII/B & Technical Specification for Civil, Structural and Architectural Work - Volume VII/C of this Bid Document.
14.10.00	All Documents/Drawings/Information as addressed in Specifications for Ventilation and Air Conditioning System - Volume III-D of this Bid Document.

Requirements of Documents/Drawings/Information under 'Information' Category

14.11.00	Pipe Schedule for the complete system.
14.12.00	Valve Schedule for the complete system.
14.13.00	Isometric Piping Drawings the complete system.

DEVELOPMENT CONSULTANTS

(e-PCT-TS-K-02-2014-15 -V-III-C-Sec-II DM.doc)

V.III-C/S-II: 20

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 14.14.00 Data Sheets, Dimensional General Arrangement and Cross Sectional Drawing for each of pumps, blowers, agitators, valves, isolation gates, monorail hoists, etc.
- 14.15.00 Following test certificates/test curves/data shall be furnished :
- a) Material test certificates.
 - b) Performance tests results and characteristics curves of pumps, fans and electric drive motors.
 - c) Hydraulic test results of pressure vessels, pipes, valves, fittings, etc.
 - d) Test results to anticorrosive coatings.
 - e) Nondestructive test results as applicable.
- 14.16.00 All Documents/Drawings/Information as addressed in Technical Specifications for Instrumentation and Control - Volume -VI of this Bid Document.
- 14.17.00 All Documents/Drawings/Information as addressed in Technical Specifications for Electrical Equipment & Accessories - Volume -V of this Bid Document.
- 14.18.00 All Documents/Drawings/Information as addressed in General Specification and Design Criteria for Civil and Structural Work - Volume –VII/A, General Specification and Design Criteria for Architectural Work - Volume –VII/B & Technical Specification for Civil, Structural and Architectural Work - Volume –VII/C of this Bid Document.
- 14.19.00 All Documents/Drawings/Information as addressed in Specifications for Ventilation and Air Conditioning System - Volume III-D of this Bid Document.

The Bidder shall submit a complete list of documents and drawings along with the category for review/approval by Purchaser.

Before manufacturing of the equipment, the Bidder shall have to take approval of the relevant design calculations/drawings from the Purchaser. Any manufacturing done prior to approval of the of the relevant design calculations/drawing shall be at risk of the Bidder and in case of any discrepancy with reference to approved design calculations/drawings rectification shall be made by the Bidder at their own cost without any violation of delivery schedule.

It is to be noted by the Bidder that approval or release of Documents / Drawings by Purchaser does not include the checking for drafting and other errors, but only review of basic concepts and general principles involved. Approval does not relieve the Bidder from responsibility for correctness of design, details and dimensions.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME: IIIE

SECTION-V GENERAL TECHNICAL REQUIREMENT FOR LOW PRESSURE PIPING, VALVES AND SPECIALITIES

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES AND STANDARDS
3.00.00	SCOPE OF WORK
4.00.00	GENERAL DESIGN AND CONSTRUCTION
5.00.00	DRAWINGS, DATA, INFORMATION & MANUALS
6.00.00	BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF L.P. PIPING

ATTACHMENTS

ANNEXURE-I	SPECIFICATION OF PIPES FOR DIFFERENT SERVICES
ANNEXURE-II	SERVICE OF VARIOUS CATEGORIES OF VALVES
ANNEXURE-III	SPECIFICATION OF VALVES

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME : IIIIE

SECTION-V

LOW PRESSURE PIPING, VALVES AND SPECIALTIES

1.00.00 GENERAL INFORMATION

This section covers all the low-pressure piping up to 400mm NB size, associated valves and specialties that include but is not limited to the following systems.

- 1.01.00 Service Air System - shall consist of distributions service air to different buildings.
- 1.02.00 Instrument Air System - shall comprise of distribution of instrument quality air to pneumatically operated instruments/ valves/dampers.
- 1.03.00 Demineralised Water Supply system including hot well make-up water piping from condensate storage tank.
- 1.04.00 Demineralised Water closed cycle cooling system.
- 1.05.00 Service water system.
- 1.06.00 Potable water system.
- 1.07.00 Any other low pressure piping as found necessary during detail engineering shall also be included.

2.00.00 CODES AND STANDARDS

- 2.01.00 In addition to the requirements spelt out in Volume IIA, the design, manufacture, inspection and testing of the piping, fittings, valves and specialties covered under this specification shall conform, in general, to the standards and codes (latest edition) mentioned below:

- 2.01.01 IS-1239 : Mild steel tubes, tubular and other wrought steel fittings.
[Part-I & II]
- 2.01.02 IS-3589 : Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
- 2.01.03 IS-554 : Dimensions for pipe threads where pressure tight joints are required on the threads.
- 2.01.04 IS-1363 : Hexagonal head bolts, screws and nuts (size range M5 M36)
[Part-I & II]

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIIE-Sec-5)

V.IIIIE/S-V : 1

Telangana State Power Generation Corporation Ltd. EPC Bid Document
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW) e-PCT/TS/K/02/2014-15

2.01.05	IS-1364	:	Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)
2.01.06	IS-3138	:	Hexagon bolts & nuts (M42 to M150)
2.01.07	IS-5312	:	Swing check type reflux (non-return) valves.
2.01.08	IS-2379	:	Colour code for the identification of pipelines.
2.01.09	IS-2016	:	Plain washers
2.01.10	IS-2712	:	Compressed asbestos fibre jointing
2.01.11	ANSI B-16.5	:	Steel pipe flanges and flanged fittings
2.01.12	ANSI B-16.9	:	Wrought steel Butt welding flanged
2.01.13	ANSI B-16.11 : ANSI B-36.10 :		Forged steel fittings, Socket-welding and Threaded. Steel pipes thickness
2.01.14	API-600	:	Steel gate valves
2.01.15	BS-2633	:	Class I Arc welding of ferrite steel pipe work for carrying fluids.
2.01.16	BS-534	:	Specification for steel pipes and specials for water and sewage.
2.01.17	BS-5351	:	Specification for Ball valves.
2.01.18	AWWA-C-504	:	Specification for Butterfly valves.
2.01.19	AWWA-C-208	:	Dimension for fabricated steel water pipe fittings.
2.02.00	Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Purchaser.		
3.00.00	SCOPE OF WORK		
3.01.00	The equipment and materials to be supplied shall include but not be limited to the following:		
	a)	Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc. as required for the piping system under the scope of this section.	
	b)	Matching pipes, matching pieces like reducers/enlargers etc., counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc.	
	c)	Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.	

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIE-Sec-5)

V.IIIE/S-V : 2

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc. complete with the counter flanges and matching connecting pieces as required within the entire low pressure piping system.
- e) Anchors, hangers and supports, etc. as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc.
- f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping should be avoided to the extent possible.
- g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches.
- h) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc. as required for interconnecting piping, valves & fittings.
- i) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop.

3.02.00 Following general requirements shall however be provided

- a) Instrument Connections including instruments, root valves, sensing lines etc.
- b) Pipe stubs and blanking plates etc. required for chemical cleaning and hydro testing.

For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.03.00 All miscellaneous instruments

4.00.00 **GENERAL DESIGN AND CONSTRUCTION**

4.01.00 **General Considerations**

4.01.01 The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.

4.01.02 The piping system shall be complete in every detail and in accordance with the highest standard of workmanship.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 4.01.03 All design and fabrication shall be in accordance with codes/standards specified.
- 4.01.04 No pipe work shall be run in trenches carrying electrical cables.
- 4.01.05 Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.
- 4.01.06 All piping shall be identified by means of colour strips and by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.
- 4.01.07 Air release and drain branches shall be provided wherever necessary depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.
- 4.01.08 Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher.
- 4.01.09 **Drain Pipe Work**
- a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.
 - b) Unless otherwise stated, all drain piping shall be of 25 mm NB minimum and all vent pipings shall be of 15 mm NB size minimum. For pipes up to 50mm NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.
 - c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.
- 4.01.10 Specification of pipes used in different services included in the L.P piping section has been detailed in Annexure-I.
- 4.02.00 **Material Specification**
- 4.02.01 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Purchaser depending on the merits of alternative material.
- 4.02.02 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**
4.03.00 Fabrication

Except where otherwise specified all piping shall have butt-welded connections with a minimum of flanged joints necessary for maintenance. Where flanges are adjacent to welded fittings, weld neck flanges shall be used.

Branches shall, in general, be formed by welding. Standard fittings may be used in positions and for sizes where approval has been given in detail drawings. Pipe bends and tees shall be truly cylindrical and of uniform section. all welded branches shall be reinforced where needed as per the applicable codes/regulations.

4.03.01 Piping shall be fabricated in the shop in the largest transportable sections to minimize the number of field weld joints. The choice of field weld joints locations shall be based on the traverse of the pipe through walls, floors, sleeves or other restrictive areas. Support attachments for major piping shall be done at shop.

4.03.02 All pipes bends shall be made true to angle with no negative tolerance and shall have a smooth surface free of flat spots, crease and corrugations. A cross section through any bent portion of the pipe shall be true in diameter, within plus or minus 3% of the pipe diameter. Pipe bends shall be made from straight pipe pieces of sufficiently higher thickness so that after thinning, the minimum thickness of bends shall not be less than the minimum thickness required for the straight pipe. Thinning allowance shall be considered as per the relevant code.

4.03.03 For bends in pipes straight piece of pipes shall be bent by the contractor to required bend radius. However, forged bends (Bend radius = 1.5 x pipe diameter) wherever required shall be provided.

4.03.04 The ends of Pipe and welded fittings shall be bevelled according to details shown in the relevant piping code. All welding shall be made in such a manner that complete fusion and penetration are obtained without an excessive amount of filler metal beyond root area. The reinforcement shall be applied in such a manner that it shall have a smooth contour merging gradually with the surface of adjacent pipe and welded fittings. Backing rings shall not be used on any pipe welds, unless otherwise approved by the Engineer.

4.03.05 Cutting and Bevelling

- a) Carbon steel piping - End preparation for butt welding shall be done by machining/flame cutting.
- b) Socket welding - Socket weld and preparation shall be done by saw or machine cutting.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**
4.04.00 Hangers, Supports, Anchors

Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item shall be supported in such a way that the weight of the piping is not taken by the plant item.

4.04.01 Support spacing shall be as per good engineering practice. However in no case it shall be less than support spacing stipulated in ANSI B31.1.

4.04.02 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.

4.04.03 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required.

4.04.04 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by welding, by bolting or by beam clamps. Bolt holes shall be drilled not burned. Support components may be bolted to concrete using approved concrete anchors.

4.05.00 Valves and Accessories
4.05.01 General Requirements

- a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure-II & III. In general all pumps (other than sump pumps), discharge valves shall be motor operated only. Tank inlet valves shall be motor operated only.
- b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs should be avoided as far as possible.
- c) All valves shall, unless otherwise stated, have the internal diameter same/as the internal diameter of the pipes to be joined.
- d) All valves shall receive tests at manufacturer's or contractor's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Purchaser.
- e) Gate valve and Ball valve have been specified with the intention of achieving isolation and tight shut-off. In full open condition, these valves should offer minimum of resistance to fluid flow.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- f) Globe valves have been specified with the intention of achieving good control of fluid passing. The plug and seat will have therefore suitable profiles for obtaining such controlling action.
- g) Check valves have been specified in order to prevent reverse flow through them.
- h) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate.
- i) Material, design, manufacture, testing etc. for all valves and specialties along with the accessories shall conform to the latest editions of codes.
- j) By pass valves shall be provided for larger size valves as per standards followed and as felt necessary for smooth and easy operation, even though not specifically mentioned in the specification.
- k) All flanged valves and specialties to be supplied under this section shall be provided with two (2) counter flanges, bolts, nuts, washers, gaskets etc.
- l) All valves shall be of approved design and manufacture. Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Purchaser's approval.
- m) All valves shall have outside screwed spindles and screwed thread of spindle shall not pass through or into the stuffing box. Where valves are exposed to the weather, protective covers shall be provided for the spindles, which shall be subject to approval.
- n) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items:
 - i) Hand wheel with embossed open and shut directions.
 - ii) Local position indicator.
 - iii) Motorised operation as specified by Engineer.
- o) Gate valves, in addition shall be provided with following extra features
 - i) Bypass valve for larger valves
 - ii) Draining arrangement
 - iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation.
 - iv) Motorised operation as specified by Engineer.
- p) All gate and globe valves shall be rising stem type.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- q) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also.
- r) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties.
- s) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position.
- t) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided.
- u) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction.
- v) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.
- w) Plastic or bakelite valve hand wheels will not be accepted.
- x) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers.
- y) Wherever practicable heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500 kg. shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable.
- z) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.
- aa) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- bb) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction.
- cc) All sampling and root valves shall be of integral body bonnet type.
- 4.05.02 For Design Requirements for different valves refer Annexure-II & III.
- 4.06.00 **Safety/Relief Valves**

Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.

All safety valves shall be provided with manual lifting lever.

Valves used for air and any other compressive fluid shall be of pop type.

Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure.

Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer.

The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting.
- 4.07.00 **Hosepipe and Accessories**
 - 4.07.01 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves.
 - 4.07.02 Hose pipes with fittings for Service Water System:
 - a) The water hose shall be as per IS-444 (Type-3).
 - b) Length of each hose shall be 15 metres.
 - c) For each hose, one end shall be fitted with M.S. female coupling with swiveling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swiveling nut of a second hose whereby two hose lengths may be joined.
 - 4.07.03 Hose pipes with fittings for Compressed air System
 - a) The compressed air hose shall be as per IS-911 (Type 2).

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- b) The length and type of each end shall be similar to as specified in above clause no. (4.07.02) above.

5.00.00 DRAWINGS, DATA, INFORMATION & MANUALS

5.01.00 Drawings, data, Information to be furnished by the Bidder besides those already mentioned in volume : IIA with the offer.

5.01.01 A complete list of all piping and fittings of various sizes with their quantities and details e.g. nominal size, O.D., I.D. (as applicable) thickness, design pressure, design temperature, material of construction/code/standards etc.

5.01.02 A complete list of all valves with their type, quantities & ratings.

5.01.03 Manufacturer's catalogue indicating complete range of available size and rating of pipes & fittings.

5.01.04 Descriptive literature on the manufacturing process and quality control procedures highlighting the manufacturing, fabricating and testing facilities available in the shop.

5.02.00 After Award of Contract

Detail drawings including fabrication drawings of all shop fabricated piping system indicating design parameters and complete bill of material (Relevant Standards and grades to be indicated) and information/data pertaining to the hydrostatic and non-destructive test requirements to be submitted progressively.

5.02.01 Detail dimensioned drawing of each valve, specialties, indicating tag no., pressure rating, manufacturing standard, the bill of materials and hydrostatic test pressures. The drawing shall include the end preparation details and shall indicate the position of the hand wheel/operator. Technical particulars of motor operators wherever applicable shall also be indicated.

5.02.02 General arrangement drawing for each hanger/support/anchor etc. indicating identification number, auxiliary supporting structural details, other details & information as required in the specification.

5.02.03 Wiring diagram for all limit switches of motor operated valves.

5.02.04 The loading data required for design of structures shall be furnished well in advance to suit Purchaser's time schedule.

6.00.00 BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING

6.01.00 All fittings like "T" pieces, flanges, reducers etc. shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.

6.02.00 Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- part of work and is required to carry out such work as per instruction of Owner, which shall include specified heat-treatment procedures, etc. also wherever required.
- 6.03.00 Certain adjustments in length may be necessary while erecting high pressure pipelines and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.
- 6.04.00 Suspension for piping, pressure parts, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 6.05.00 All the valves, lifting equipments, actuators, power cylinders, etc., shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and also during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, they have to be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.
- 6.06.00 All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over the end caps shall be put back in tube openings till such time they are welded to other tubes.
- 6.07.00 Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even after completion of erection, which shall be carried out by the Bidder without any extra cost to the Purchaser. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions.
- 6.08.00 No temporary supports shall be welded on the pressure parts. Welding of temporary supports, cleats, etc., on the building columns shall also be avoided. In case of absolute necessity, Contractor shall take prior approval from Engineer. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Engineer.
- 6.9.00
- a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.
 - b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance.
 - c) Piping shall be routed above ground unless otherwise specifically indicated/ approved by the Engineer. In such special case, the piping may be arranged in trenches, or buried and properly protected as per AWWA Standards.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 7 meters above roadways unless otherwise approved by the Engineer.
 - e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective drawings or not. The pipelines shall be sloped towards the drain points.
- 6.10.00 All drips and drains for piping and equipment whether shown in the drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. Leading such drains up to station drainage is also the responsibility of the Contractor.

TABLE-1

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

ANNEXURE-I SPECIFICATION OF PIPES FOR DIFFERENT SERVICES				
	A	B	C	D
Services	1. Clarified Water piping 2. DMCW piping	1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)	1. Demineralised Water, Service and Instrument Piping less than and equal to 50 mm NB	1. Demineralised Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB
1.00.00 Material of Pipe	Carbon Steel IS-1239 Heavy Grade upto 150 mm NB and IS-3589 for sizes above 150 mm with minimum pipe thickness of 6 mm.	Carbon Steel as per IS-1239 Heavy Grade for sizes upto 150 mm NB and IS-3589 for sizes above 150 mm NB with minimum pipe thickness of 6 mm. The pipes shall be galvanized as per IS-4736	Stainless Steel as per ASTM A-312 Gr. 304. Size- as per schedule 40 ANSI B36.10	Stainless steel as per ASTM A-312 Gr. 304. Size-upto 150 mm NB as per schedule 10S, ANSI B-36.10.
2.00.00 Construction	ERW / Seamless	ERW / Seamless	ERW	ERW
3.00.00 Joints	Slip-on Flange and butt weld for size 65 mm NB and above and Socket weld joint for size 50 mm NB and below.	Screwed flange for sizes 65 mm NB and above and screwed socket for size 50 mm NB and below.	Socket welded for size 50 NB and below	Slip-on flange and butt weld joint.
4.00.00 Fittings	Pipe Sizes > = 65 mm NB Pipe Sizes < = 50 mm NB	Pipe Sizes > = 65 mm NB Pipe Sizes < = 50 mm NB		

**DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIIE-Sec-5)**

V.IIIIE/S-V : 13

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

A		B		C	D	
Services	1. Raw water piping, Clarified Water piping, sludge handling piping 2. DMCW piping	1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)		1. Demineralised Water, Service and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB	
	4.01.00 Materials	ASTM-A-234 Gr. WPB	ASTM-A-105	ASTM-A-234 Gr. WPB galvanized as per IS-4736	ASTM-A-105 galvanised as per IS-4736	ASTM-A-182 F304
4.02.00 Construction	Welded/ Seamless	Forged	Welded/ Seamless	Forged	Forged	Welded/Seamless
4.03.00 Standard	ANSI-B-16.9 for fabricated fitting AWWA-C-208	ANSI-B-16.11	ANSI-B-16.9	ANSI-B-16.11	ANSI-B-16.11	MSS-SP-43
4.04.00 End details	Pipe size >=65mm NB Butt welded as per ANSI-B-16.25	Pipe size <=50 mm NB Socket welded as per ANSI-B-16.11	Pipe size >=65 mm NB Screwed Flanged	Sizes <=50 mm Screwed socketed as per ANSI-B-16.11All fittings shall be galvanized.	Socket welded	Slip - on flanges

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIIE-Sec-5)

V.IIIIE/S-V : 14

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

	A		B		C		D	
Services	1. Raw water piping, Clarified Water piping, sludge handling piping 2. DMCW piping	1. Drinking/ Potable Supply, piping (Clarified water, chlorinated)	1. Demineralised Service and Instrument Piping less than and equal to 50 mm NB	Water	Water, Air	Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB		
5.00.00 Flanges	150 lb class as per ANSI-B-16.5 complete with nuts, bolts and gaskets	As per ANSI-B-16.5 pressure class 150lbs - galvanised-complete with nuts, bolts and gaskets.	As per ANSI-B-16.5 pressure class 150lb complete with nuts, bolts and gaskets. Material as per class 4.01.00.			150lb class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets.		
Pipes which fall under IS:1239 shall be hydrostatically tested according to the said code, for others refer Section-V, Vol.: II-A.								

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIIE-Sec-5)

V.IIIIE/S-V : 15

Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)

EPC Bid Document
e-PCT/TS/K/02/2014-15

ANNEXURE-II

SERVICES OF VARIOUS CATEGORIES OF VALVES

Valve Classification		Service		
A.	Cast iron body Gate/Globe/Check Valve	i)	Service Water	For sizes 65mm NB and above.
		ii)	Clarified Water	
		iii)	Drinking/ Potable Water	
		iv)	Inhibited Demineralised Water	
B.	Stainless steel body/ Gate/Globe /Check/Ball Valve	i)	For Demineralised water	For all sizes
		ii)	Potable/ Drinking Water	For sizes less than and equal to 50 mm NB
		iii)	Service and Instrument Air	For all sizes. Ball valves to be used in air line.
C.	Steel Body valves	i)	Clarified Water	For sizes less than and equal to 50 mm NB
		ii)	Inhibited Demineralised Water for DMCW system	
D.	Cast Iron body butterfly valve	i)	For Demineralised Water	For butterfly valve specification refer Annexure II, Sec.IV of Vol. IIIE. For DM water line rubber lining/ EPDM/equivalent protection to be provided
		ii)	Raw water	
		iii)	Clarified Water	
		iv)	Filtered Water	
		v)	Inhibited Demineralised Water for DMCW system	

ANNEXURE-III

SPECIFICATION OF VALVES

	A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
1.00.00	Valve Classification	SSGC	STGC
2.00.00	Basic Design Code		
	a) Gate		
	i) IS 780 for 50 mm - 300 mm NB	a, b, c) ANSI-B-16.34	i) API 600 for 50mm
	ii) IS2906 for 350 mm NB and above or as per MSS-SP-70		ii) API 602 for size
	b) Globe		b) BS-1873/ANSI-B-16.34
	c) Check		c) BS-1868/ANSI B16.34
	d) Ball	d) BS-5351	
3.00.00	Pressure Class	To be suitably chosen considering the pressure requirement. Refer Clause No. 4.01.08 in this regard.	
4.00.00	Construction	Cast body and bonnet / cover	Same as Group-B
5.00.00	Material		
5.01.00	Body & Bonnet/ cover	IS 210 Gr. FG 260	ASTM-A-216 Gr. WCB for cast body & ASTM-A-105 for forged body

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

	A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
5.02.00	Trim / Disc.	IS-210 Gr. FG 260	13% Cr Steel as per ASTM-A-182 Gr. F6 heat treated and hardened(min 250 NB) for cast body and ASTM-A-105 Hard faced with Stellite (min 350 HB) for forged body
5.03.00	Seating surface	13% Cr steel as per IS 1570	13% Cr. Steel as per ASTM-A-182 Gr. F6
6.00.00	End Preparation	Socket welded for size equal to and below 50mm NB and flanged with counter flanges for 65mm NB and above.	
7.00.00	Testing		API-598
	a) Gate	i) As per IS - 780 for 50 mm - 300 mm NB ii) IS-2906 for sizes equal to and above 350 mm NB Hydrostatic Test as per MSS-SP-85	As per ANSI B-16.34
	b) Globe	IS-5312/MSS-SP-71	BS-1873 BS--1868
	c) Check		

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol III-E-Sec-5)

V.III/E/S-V : 18

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME : IIIE

SECTION-IV

GENERAL TECHNICAL REQUIREMENT FOR LARGE DIAMETER LOW PRESSURE PIPING, VALVES AND MISC. TANKS

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES AND STANDARDS
3.00.00	SYSTEM DESCRIPTION & SPECIFIC REQUIREMENTS
4.00.00	SCOPE OF WORK
5.00.00	DESIGN AND CONSTRUCTION
6.00.00	EXCAVATION AND BACKFILLING
7.00.00	CIVIL WORKS
8.00.00	TESTING AND INSPECTION
9.00.00	PAINTING
10.00.00	DRAWINGS, CURVES AND INFORMATION REQUIRED

ATTACHMENTS

ANNEXURE-I	SPECIFICATION OF MISCELLANEOUS TANKS
ANNEXURE-II	BUTTERFLY VALVE SPECIFICATION

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME : IIIIE

SECTION-IV

**LARGE DIAMETER LOW PRESSURE PIPING,
VALVES AND FABRICATED TANKS**

1.00.00 GENERAL SPECIFICATION

This specification is intended to cover the design, supply of steel plates, structural steel and all accessories as required, associated civil works, paints and protective paintings as specified and as required, fabrication, erection, painting, testing of the following items with accessories as specified.

1.01.00 The Large Diameter Piping to be fabricated and installed shall include the following pipe lines having sizes 450 mm NB and above:

- a) Circulating Water Piping
- b) Auxiliary Cooling Water Piping
- c) Raw Water Piping
- d) DM Closed Cooling Water Piping
- e) Cooling Tower Make-up Water Piping

1.02.00 The different steel storage tanks are :

- a) Demineralised Water make up tank.
- b) Potable Water Storage Tank.
- c) Service Water RCC Tank.
- d) Demineralised Water storage tanks
- e) Condensate Storage Tank
- f) Fire Water Storage Tanks

1.03.00 Rubber Expansion Joints

1.04.00 Spring supports for CW pipes

2.00.00 CODES AND STANDARDS

In addition to the requirements spelt out in Vol.-IIA, the equipments to be supplied under this section shall conform to the following Codes and Standards as required.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15
2.01.00 Large Diameter Piping

2.01.01	Material of pipe	:	IS-2062 - Code for Structural Steel
2.01.02	IS-817	:	Code of practice for Training and testing of metal arc welders
2.01.03	IS-1367	:	Technical supply conditions for threaded steel fasteners

2.02.00 Steel Storage Tanks

The design, manufacture and testing of tanks shall comply with the requirements of one or more of the following standards as applicable.

2.02.01	IS - 803	:	Code of practice for design, fabrication, and erection of vertical mild steel cylindrical welded oil storage tank.
2.02.02	IS - 804	:	Rectangular pressed steel tank
2.02.03	IS - 805	:	Code of practice for use of steel in gravity water tank.
2.02.04	IS - 816	:	Code of practice for use of metal arc welding for general construction in mild steel.
2.02.05	IS - 823	:	Code of procedure for manual metal arc welding of mild steel.
2.02.06	IS-2825	:	Code for unfired pressure vessels.
2.02.07	API-12D	:	Large welded production tanks
2.02.08	API-12F	:	Small welded production tanks
2.02.09	API-620	:	Recommended rules for design and construction of large welded, low pressure storage tanks.
2.02.10	API-650	:	Welded steel tank for oil storage.
2.02.11	BS-1564	:	Pressed steel tank
2.02.12	BS-2594	:	Carbon steel welded horizontal cylindrical tank
2.02.13	AWWA-C-504	:	Butterfly valve

2.03.00 Rubber Expansion Joints

The design, material requirement, manufacture, testing and performance requirements of the Expansion Joints shall generally conform to one or more of the following codes and standards/ documents :

2.03.01	Expansion Joints Manufacturers Association (EJMA), USA, Standards.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 2.03.02 Fluid Sealing Association, U.S.A.: Technical Handbook-Rubber Expansion Joints and Flexible pipe connectors.
- 2.03.03 Other International Standards, equivalent to above.
- 2.04.00 Spring supports for C.W. pipe - Spring supports shall conform to the following codes and standards as applicable:
- 2.04.01 IS-1570 : Schedule for wrought steel
- 2.04.02 IS-2062 : Weldable Structural Steel
- 2.05.00 The technical requirements of the various equipments shall be guided by the design criteria and the Data specification sheets. In case of any contradiction between the aforesaid standards and stipulations of the design criteria and data specification sheets, the stipulations of design criteria and the data specification sheets shall prevail.
- 3.00.00 **SYSTEM DESCRIPTION & SPECIFIC REQUIREMENTS**
- 3.01.00 The different large diameter piping systems are as follows :
- 3.01.01 The Circulating Water Piping will be used for supplying water for condenser cooling from the CW pump house sump by C.W. Pumps to the condenser and also for taking out the hot water from the outlet of condenser to the inlet of hot water distribution system of cooling towers. The scheme of C.W. piping has been shown in drawing no 13A06-DWG-M-001G.
- 3.01.02 Auxiliary cooling water piping will be used for supplying cooling water from the sump of C.W. pump house by Auxiliary C.W. pumps for cooling the closed cycle cooling DM water through Plate Heat Exchangers. ACW piping shall also be used for taking out the hot water from these coolers to the cooling towers. The scheme of Auxiliary C.W. piping has been shown in drawing no 13A06-DWG-M-001G.
- 3.01.03 Raw water piping will be used for supplying water to clarifier from the Raw water Reservoir.
- 3.01.04 DM closed cooling water piping will be used for supplying cooling water to boiler and turbine auxiliary equipments as well as for other auxiliary equipments like compressors etc.
- 3.01.05 Cooling tower make-up water piping used for supplying make-up water to cooling tower.
- 3.02.00 The details of Miscellaneous steel tanks for storage of water at atmospheric pressure to be fabricated and erected under this section of specification are given as follows :
- 3.02.01 One (1) potable water tank will be installed on the power house roof.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 3.02.02 One (1) Demineralised water (DMCW) make-up tanks will store demineralised water for supplying make-up quantity to the demineralised closed cooling circuit of the Plant. These tanks will be located at an elevated level, in the Power House.
- 3.02.03 One Service water RCC tank shall be located at a suitable height in the power plant.
- 3.02.04 One Condensate Storage Tank (CST) will store demineralised water for supplying DM water for power cycle make up.
- 3.02.04 Two Demineralised water Storage Tanks will store demineralised water for supplying DM water to condensate storage tank for power cycle make up.
- 3.02.05 Two Fire water Storage Tanks will store clarified water for supplying to fire fighting system. The MS fire water tank sizing to be done by the EPC contractor during detail engineering meeting the TAC/ NFPA requirement. However, each fire water tank capacity shall not be less than 1500 cum.
- 3.03.00 **Rubber Expansion Joints**
- 3.03.01 The expansion joints will be used on C.W Pipes at inlet and outlet of condenser to absorb relative movement between C.W Pipes and condenser and at discharge header of each CW & ACW pumps.
- 3.03.02 The expansion joints shall be designed for the maximum pressure that may appear in the C.W and ACW system considering shut-off, water hammer, back wash and other operating conditions. The condenser shall be designed to withstand the maximum axial thrust from the inlet and outlet nozzles and pressure compensation type expansion bellow shall be provided for CW inlet and outlet of condenser.
- 3.04.00 Spring supports if required shall be provided for supporting C.W pipes at inlet to and outlet from the condenser.
- 4.00.00 **SCOPE OF WORK**
- 4.01.00 **Large Diameter Piping**
- 4.01.01 Supply and Installation of all piping system as mentioned against Clause 3.01.00 above, and shown in relevant drawings complete with all interconnections including connections with pump flanges and condenser/ equipment flanges wherever required, bends, reducers, tees, distant pieces etc. of all sizes and shapes as required for complete installation of the piping system. The nominal size of various pipes in different sections to be fabricated from steel plates are 450 mm N.B and above.
- 4.01.02 Erection of all vents, drains, instrument tapping points with stubs up to root valves and thermometer well etc.
- Drains, vents, thermometer wells and instrument stubs up to root valves etc. Connected with the above pipelines may be erected from straight length of piping. All bends, reducers, distant pieces, tees, etc. of all shapes and sizes

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIE-Sec-4)

V.IIIE/S-IV : 4

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- shall, however, have to be fabricated as necessary. All materials required for the same shall be supplied by the Contractor at his own cost.
- 4.01.03 Valves, Flanged butterfly valves, strainers, flanges, root-valves other accessories shall be provided. Butterfly valves at condenser inlet and outlet shall be provided with Power actuators. Over and above, those specified above, the Bidder shall provide additional valves/strainers etc. if required for safe and trouble-free operation of the systems. All the slip-on type counter flanges, blank flanges, caps, etc. necessary for the piping, shall be fabricated and installed by the Contractor to make the installation complete in all respect. All materials for the same shall be supplied by the Contractor at his own cost. All necessary bolts, nuts & gaskets required for installation of the system shall also be supplied by the Contractor. For details of Motor Actuators, Volume-V shall be referred.
- 4.01.04 All flanged manhole and manhole covers, flanged tees with blank flanges appearing on above piping are included in the scope of work. Also all flanged tees and blank flanges for tapping water supply from these pipelines to meet the necessity of Owner's other equipment are included. All materials required for the same shall be supplied by the Contractor.
- 4.01.05 Steel hanger, supports, saddles, clamps etc. required for all the pipes at locations as indicated in the attached drawings and as required will be designed, fabricated and erected by the Contractor after approval of the relevant drawings. Supports, clamps etc. for pipeline in pipe trenches, if any and other places are also to be designed by the Contractor and fabricated and erected by Contractor after approval of his relevant fabrication drawings. All materials required for the same and also the trenches shall be made by the Contractor at his own cost.
- 4.01.06 All angle rings and annular rings that are to be welded in the piping for grouting in the wall openings are included. All necessary seating plates for all pipe supports with anchoring arrangement including steel straps, wearing plates to be welded to the piping system etc. are included. The concrete pedestal, thrust blocks etc. where required, shall have to be provided by the Contractor. The seating plate shall also be grouted by the Contractor. Necessary anchor bolts, nuts, sleeves etc. shall be supplied by the Contractor.
- 4.02.00 **Miscellaneous Steel Tanks**
- The miscellaneous steel tanks to be designed, supplied, fabricated and erected under this specification.
- 4.02.01 The connections, accessories and fittings to be supplied with each tank shall be as indicated in the respective drawings, specification and as required. The piping material required inside or outside up to the flanged terminal shall be supplied by the Contractor.
- Tank connections shall be provided with suitable counter flanges with necessary bolts, nuts & gaskets by the Contractor.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS****EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 4.02.02 The tank, where applicable, shall be complete with supporting structure, legs or pedestals, base plate, anchor bolts, nuts & sleeves etc. as required.
- 4.02.03 The special fittings, e.g. conservation vent valves, level indicators etc. shall be supplied by the Contractor.
- 4.03.00 Preparation of detailed design, fabrication drawings, bill of materials, tag and piece numbers, welding procedure, etc.
- General layout showing pipe routing, location of expansion joints, butterfly valves, etc. shall be furnished by the Contractor.
- 4.04.00 This specification covers supply of steel plates, structural steel, pipes etc. as required for complete installation.
- 4.05.00 The scope of work under this specification shall include excavation and backfilling work required for installation of pipes running underground.
- 4.06.00 Minor concrete works like pipe supports, thrust blocks, etc. as required will be supplied and erected by the Contractor at his own cost. Necessary steel work at supports shall also be supplied, fabricated and erected by the Contractor.
- 4.07.00 The final fixing grout over the concrete support or through the opening left in the concrete work shall be done by the Contractor.
- 4.08.00 **Rubber Expansion Joints**
- The scope of supply under this specification shall be as below. Items not mentioned but deemed necessary by the Bidder for making the system completely reliable and efficient shall also be included.
- 4.08.01 Expansion joints with retaining rings and requisite nos. of fixing bolts, nuts, washers gaskets connection, bellow with the companion/equipment flange.
- 4.08.02 Various accessories like companion flanges, control rod/unit assembly including stretcher plates, limit rods, washers nuts, bolts etc.
- 4.09.00 Required number of spring supports as detailed shall be supplied.
- 5.00.00 **DESIGN AND CONSTRUCTION**
- 5.01.00 **Large Diameter Piping**
- 5.01.01 The pipe sizes chosen shall be the next higher size to that calculated by taking velocity of water as 2 m/s.
- 5.01.02 All piping to be fabricated under this section shall be made of tested quality mild steel plates having thickness not less than that stated below :
- | | |
|-----------------|---------------------------|
| Pipe Dia. (O.D) | Plate Thickness (Minimum) |
| Upto 800 mm | 10 mm |

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

Above 800 mm	12 mm
- For pipe diameter greater than 2500 mm NB, RCC duct with MS plate inside lining may be used. Bidder may also provide alternate MOC for these size range subject to however, Owner's approval.
- 5.01.03 All plates used will be of mild steel quality conforming to IS-2062 Gr B (latest revision) or equivalent.
- 5.01.04 Flanges should be machined on both faces. Fabrication of flanges from segment plates should be avoided. However, if under special circumstances flanges from segment plates are to be provided, on specific instructions of the Owner/Consultant, such flanges should be completely stress relieved after welding and all welds shall be subject to dye penetration test. These flanges should also be machined.
- 5.01.05 All welds are to be continuous single V butt with finished head of size equal to thickness of plate. All welding shall be as per IS- 817 (latest revision).
- 5.01.06 The pipe circumferential weld shall be done in such a way that the longitudinal welds become staggered in any two consecutive sections.
- 5.01.07 Pipe sections in straight lengths delivered at erection site shall be of suitable length to minimise field joints as far as possible. End preparations shall be done at the fabrication yard to facilitate site welding.
- 5.01.08 The piping shall be prepared cold rolled to true cylindrical shapes in a number of passes in a plate bending machine so that no undue stresses are developed.
- 5.01.09 Manholes shall be provided wherever required and the sizes shall conform to the requirement. All manholes shall be provided with flanged covers with handle, gasket, bolts, nuts etc. Manhole pits shall be provided for buried piping at regular intervals of 100 m. Valve pit, if required shall be provided for buried piping system for accessibility and maintenance of the valves. The design of the valve pit shall be approved at the detail Engineering Stage.
- 5.01.10 Gaskets shall be 3 mm thick full-face rubber.
- 5.01.11 Bolts and nuts shall be hexagonal head conforming to IS-1367 (latest revision).
- 5.01.12 The pipe sections shall be carefully placed on the sand bed prepared as specified before and then welded. The method of holding the pipe sections in position for welding during erection shall be approved by the engineer. All joints before welding shall be thoroughly cleaned and requisite welding gap maintained.
- 5.01.13 Welding shall be carried out as per provisions laid down in IS-816 (latest revision). Welding shall be done by experienced and good operators who have been qualified by tests as specified in IS-817 (latest revision).

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 5.01.14 Welding sequence shall be done in such a way so as to minimise the distortion due to welding shrinkage. Any distortion will be duly rectified by the Contractor.
- 5.01.15 Welding shall not be carried out when the surface of the parts to be welded are wet for any cause and during periods of rain and strong winds unless the welder and work are properly shielded.
- 5.01.16 The unpainted ends of pipe surface shall be painted after completion of jointing. Precaution shall be taken to prevent any crack or damage in the external coating during installation. Pipes shall be laid in trenches excavated along the route and the overground portion shall be installed as per final layout drawings furnished to the Contractor.
- 5.01.17 On completion of all welding in the pipe lines, the same shall be tested hydrostatically and after successful testing, shall be covered by sand wrapping and backfilling with earth as specified elsewhere in this specification.
- 5.01.18 Installed pipe shall be closed up at both ends at the end of each day by watertight plug or other means approved by the Owner to prevent debris/ animals/human beings from entering the pipe.
- 5.02.00 **Steel Storage Tanks**
- 5.02.01 Tanks shall be suitably constructed for safe, proper and continuous storage of liquid described. The design code, material standard, minimum plate thickness, size and other details shall be as per the specified Codes and Standards as applicable.
- 5.02.02 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature. For rectangular pressed steel tank, the plates shall be heated uniformly in a furnace and formed in a press, each of which is capable of taking the whole part at a time. Alternatively, the plates may be pressed cold, the flanges made by V-die and the corners welded provided no cracks are developed.
- 5.02.03 Vessel seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessels consisting of more than two sections, longitudinal seams shall be offset.
- 5.02.04 Where possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.
- 5.02.05 For vessels with dished ends, Bidder shall submit in his quotation details of the proposed dished ends. The details shall comprise of the following :
- a) The method of manufacture.
 - b) Knuckle and crown radii and length on straight.
 - c) Whether dished ends are fabricated in one piece or segmented.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- d) A sketch showing number of segments and seam arrangement, if segmented ends are proposed.
- 5.02.06 Proper means shall be provided against the chance of over-turning effect of wind on an empty vertical cylindrical tank.
- 5.02.07 Due consideration for wind load and/or earthquake effect shall be given by the Contractor in the design of tanks. Data for wind load and earthquake shall be taken as indicated in the Vol. IIA. Maximum allowable stresses for design loadings combined with wind or earthquake shall not exceed 133% of stress permitted for the design loading condition but in no case shall exceed 80% of specified minimum yield strength of the material.
- 5.02.08 Except where otherwise indicated in the Owner's drawings/ specifications, if the stiffening of the shell and/or roof is necessary the same shall be stiffened from outside.
- 5.02.09 Reinforcement pads in tank connections shall be provided as per applicable code & the reinforced connection shall be completely preassembled into a shell plate. The completed assembly including the connection shall be thermally stress-relieved as per API Standard 620 if specified.
- 5.02.10 All welding shall be done as per IS803, 817, 823 and IS:816, latest revision as applicable. All welds are to be continuous welds. Bidder shall clearly state in his offer the make and type of welding rods proposed by him for fabrication. Inspection of welding shall be carried out in accordance to IS-822, IS-823. Welding sequence shall be adopted in such a way so as to minimise the distortion due to welding shrinkage, Contractor shall indicate in his Drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.
- 5.02.11 Tank Connections
- a) Bidder shall furnish all piping material required for the tank connections.
- b) Unless otherwise specified, for all flanged connections Bidder shall furnish suitable counter flanges and the necessary nuts, bolts, gasket.
- c) Flange faces of all nozzles shall be machined and square with the vessel centrelines.
- d) Unless otherwise stated bolts and nuts shall be of hexagonal head conforming to IS:1367, latest revision.
- The material and thickness of gaskets shall be suitable for the specified service. On completion of hydraulic test, contractor shall replace the gaskets used during testing at his own cost.
- e) All tanks shall be provided with connections for drains, vent and overflow. Condensate storage tank shall be provided with pump recirculation connections. Blank flanged spare inlet and outlet- 2 (two) each shall be provided for condensate storage tank and one (1) each

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

for others. Each of the above spare connections shall be provided with isolating valves.

5.02.12 Accessories

The tanks shall be provided with accessories as indicated in the Specification. All the accessories shall conform to relevant Indian Standard. The following broad guidelines are given for some of the accessories.

a) Conservation Vent Valve/Breather

Where continuous venting to atmosphere directly is not permitted for the stored liquid, a conservation vent valve or a breather of approved make & design shall be provided on each of the vent/overflow connection of the condensate storage tank. The conservation vent valves where provided, shall be designed to relieve the pressure or vacuum corresponding to plus or minus 55mm water gauge in the space above liquid in the tank. Detail cross-sectional drawing indicating materials of construction shall be submitted along with the proposal.

b) Level Indicator

Float operated or tubular gauge glass type indicator of high-grade workmanship shall be provided on each tank. Tank of height not exceeding 3m shall have tubular gauge glass and others float operated level Indicator. For tubular gauge glass, isolating valves and protective guards against mechanical shock shall be provided.

c) Level Switch

Where specified level switch of approved make & type shall be furnished along with instrument root valves. Repeat accuracy of operation shall be $\pm 1\%$ of the full range. At least two level switches one for High-level actuation and other for Low Level actuation shall be provided for each tank to motor operated gate valves at inlet lines of specified tank.

d) Dip Hatch

Each large dia cylindrical tank shall be fitted with one dip hatch. Dip hatch shall have screwed end and shall be fitted with brass cap and chain.

e) All tanks shall be provided with vertical rung ladder. In addition to this, internal vertical ladder is to be provided in all tanks where the tank height exceeds 3M, vertical ladder is to be provided with cage.

f) Top Manhole shall be provided in all tanks. Besides manhole at the side of tank shall be provided in case of condensate storage. Manhole size shall be 600mm NB(min.).

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 5.02.13 When installation of tank is specified the recommendation regarding installation in IS:803 shall be followed in general. In addition to those recommendations, the following shall also be taken care of.
- 5.02.14 The finished tank grade for cylindrical tank shall be crowned from the outer periphery to the centre with a slope. The sloping factor shall be taken as 1:36 unless otherwise specified.
- Sufficient number of plugged holes shall be provided in the bottom plate of the vertical tanks for bottom testing as specified in IS-803.
- 5.02.15 Welding shall be done in accordance with IS-803, IS-817 & IS-823.
- 5.02.16 Welding sequence shall be adopted in such a way so as to minimise the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.
- 5.03.00 **Rubber Expansion Joints**
- Design of the Expansion Joint shall take care of the axial, angular or rotational movement of the bellow and/or the equipment vibration. Axial compression or elongation of RE joint under design pressure from free condition shall be 10 mm (max.). Lateral deflection of RE joint under design pressure from free condition shall be 10-mm. Lateral deflection with simultaneous axial elongation and compression shall be 10 mm. These figures shall be confirmed based on the final details of condenser and C.W. pumps. Pressure compensating expansion bellow shall be designed to suit the requirement of condenser.
- The general design and constructional features of various components of the Expansion Joints shall be as follows :
- 5.03.01 **Body**
- a) Expansion bellow shall be manufactured from abrasion resistant natural or synthetic rubber.
 - b) The Expansion Joints shall have integral flanges at both ends complete with split retaining rings. The flanges shall be made of tough non-compressible duck to resist stresses set up when the flange bolts are tightened. The flange compound shall be designed to resist flow under bolting pressure. The boltholes drilled on the flanges shall be thoroughly coated with self-vulcanizing rubber so that edges of the plies are not exposed.
 - c) 2 sets of split retaining rings shall be installed on each Expansion Joint to increase resistance to pressure. The rings shall be made of rolled steel IS-2062, split, bevelled and galvanized. They are to be placed directly against the flange of the Expansion Joint and bolted through it to the metal flange of the pipe. Steel washers shall be used at the points where the rings are split.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**
5.03.02 Carcass

Fabrics of high strength synthetic fibers (High quantity canvas duck and polyester chord, reinforced) shall be used in suitable number of plies to hold the shape of the bellow at the working condition. All fabric plies shall be impregnated with rubber or synthetic components to permit flexibility between them.

Copper coated steel wire or solid endless rings embedded in the carcass shall be used for reinforcement of the expansion bellow.

5.03.03 Cover

The exterior and interior surfaces of the bellow shall be of Neoprene 3 mm thick shore hardness 65 ± 5 deg. durometer. Protective hypalon coatings shall be applied at the exterior.

5.03.04 Control rod assembly

Expansion Joint shall be supplied with control rod assembly to prevent excessive elongation or contraction of the bellow. Control rod assembly shall consist of long bolt, nuts & lock nuts, washers/spherical washers, connecting plates (gusset plate) for fixing the assembly with companion flanges.

Control rod assembly shall allow transverse and rotational movements under limiting axial conditions of the expansion joints.

Design of the control rod assembly shall take care of the maximum axial thrust across the bellow calculated on the basis of maximum fluid internal pressure and the internal diameter of the arch.

5.03.05 Joints shall be provided with companion flanges. Companion flanges shall be flat faced, slip-on and shall be fabricated from steel plates or forged.
5.04.00 Spring Supports
5.04.01 The spring rate for the springs to be adopted shall be around 40 Kg/mm. The no. of springs and their initial compression for each type of support shall be selected accordingly. The above details shall be furnished along with the offer.
5.04.02 Each spring selected shall not be loaded more than 60% of its maximum rated load while carrying the load.
5.04.03 The spring supports shall be taken from the ground floor and the method of attachment shall be detailed by the Bidder.
5.04.04 The material of construction of component parts shall be equal to or superior than the following :

- a) Spring : Spring steel conforming to IS-1570 Gr.50 Cr.1 V-23 or equal

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

b)	Spring housing	:	Carbon Steel to IS-2062
c)	Base plate, anchor	:	Carbon Steel Hot dip galvanised bolts, nuts, etc.
d)	Saddle	:	Carbon Steel to IS-2062
e)	Support Table	:	Carbon Steel to IS-2062

All other materials used shall be compatible with the service requirement and shall be of tested quality. In case resilient seating is found necessary, details of same with hardness, material etc. shall be indicated in the tender.

- 5.04.05 All the mounting plates, base plates, along with foundation bolts, nuts, washers etc. as required shall be supplied by the Tenderer. All items required for completing the installation of the spring assemblies shall be supplied under this section.
- 5.04.06 The support saddles shall be welded to the respective C.W. pipe at site by the Bidder. Bidder shall ensure that the supports can be placed in their respective position with the C.W. pipes already installed.
- 5.04.07 The spring assemblies shall be set at shop for loads when filled up with water. The design shall, however, permit that at site load adjustment to an extent of $\pm 10\%$ of specified loads shall be possible and even after this adjustment, the system will allow free movement of C.W. pipes under loaded and empty conditions. The offer shall clearly indicate method of adjustment proposed.
- 5.04.08 The locking device to be provided for the spring assemblies should be such that it is possible to easily unlock the springs even when there is certain amount of unbalance between the load applied on the springs and the spring reactions. This is very important as there might always be certain difference between the theoretically calculated load for which the springs will be pre-compressed at shop and the actual load that will be applied on the springs during operating conditions.
- 5.04.09 After installation of the spring supports at site with pre-compressed springs in locked condition, the C.W. pipes will be filled up with water and then the springs will be released by unloading the springs. If water in C.W. pipe is required to be drained out for any repairs/maintenance works, the springs will be locked first and then the water from the pipes will be drained out so as to avoid undue upliftment of the pipe because of loss of weight due to draining of water from the pipe. The system will be restored after repair/maintenance works by filling up the pipes with water and then releasing the locks of the springs.
- The above operation of the spring supports shall have to be demonstrated by the tenderer at site to the entire satisfaction of the Owner.
- 5.04.10 It shall be possible to take out the whole spring assembly for maintenance. Arrangement for lubrication of springs and other frictional parts shall also be provided to reduce frictional resistance.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

The spring box housing shall have drain plugs to allow draining of accumulated water/other liquid etc.

5.05.00 Butterfly Valve

5.05.01 Butterfly valve and its operator shall be of heavy duty construction and shall be designed to withstand all working conditions i.e. shall be able to open/ close or hold from/at any intermediate disc position, as required, without any difficulty under different combinations of flow and pressure.

5.05.02 The design of the valve shall take into consideration the Water Hammer effect for accidental closure of the valve disc.

5.05.03 Shaft of butterfly valves may be of single piece extending completely through the valve disc or in two pieces, stubbed into the disc hubs. The shaft diameter shall take into consideration the maximum differential pressure across the valve disc when the valve is closed and the shock load due to accidental closure of the valve disc.

5.05.04 Disc of butterfly valve shall have no external ribs transverse to the direction of flow. The disc shall be of a design that permits removal and replacement at site and shall be securely clamped on the body or disc of the valve.

5.05.05 Each butterfly valve shall be fitted with two (2) sleeve type shaft bearings, contained in the hubs of the valve body. Bearings shall be of self-lubricated type and shall not have any harmful effect due to handling fluid.

5.05.06 Shaft seals for butterfly valves shall be provided both at drive and non drive end of the shaft to prevent fluid flow to valve bearings.

5.05.07 Design of the gear reducers for butterfly valves shall conform to AWWA standard.

5.05.08 Butterfly valves to be used for flow regulation/control shall be designed to accommodate extra velocity through the valve passage to ensure normal service life. The design shall take care of the pressure drop across the valve disc due to control of fluid flow and shall take care of the erosion and cavitation effect on the body and the disc due to such operation.

For detail specification refer Annexure-II.

6.00.00 EXCAVATION AND BACKFILLING
6.01.00 Scope

This specification covers excavation in pipe trenches in all types of soil (including rock) including shoring, dewatering, back filling under pipes, transportation of earth within station premises, backfilling the excavated trenches with selected spoils, concrete encasement of pipe, compaction of fills and approaches, protective fencing, lighting and other safety measures as may be applicable, removal of surplus spoils to selected areas etc. and other works for underground pipe installations. The scope of work also covers

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

protection of adjacent structures and protection, maintenance or removal of other pipes and conduits.

6.02.01 Materials to be used

Earth to be used for filling under pipes shall be clean, graded and free from harmful and deleterious material. Borrow material, if required, for backfilling the excavated trenches, shall be excavated from approved locations and levels, and shall consist of granular material free from roots, vegetations, decayed organic matter, harmful salts and chemicals, free from lumps and clods.

Materials for shoring shall be of best commercial variety and approved by the Engineer and the same shall be arranged by the Contractor at their own cost.

Shoring materials required for the work under this clause shall be arranged by the Contractor at his own cost.

6.03.00 Execution

6.03.01 Setting out & levels

On receiving the approval from the Engineer on working drawings the Contractor shall set out the work from the control points furnished by the Engineer and fix permanent points and markers for ease of future checking. These permanent points and markers will be checked by the Engineer and certified by him after whom the Contractor will proceed with the work.

The Contractor will help the Engineer with men, materials, tools & instruments for checking purpose. It should be noted that this checking by the Engineer prior to start of the work will in no way absolve the Contractor of his responsibility of carrying out the work to true lines and levels and grades as per drawings and subsequent corrections, if necessary, free of cost to the Owner in case any errors are noticed in the Contractor's work at any stage.

The clearance for starting excavation work in different areas within the work may be given separately by the Engineer in co- ordination with other Project work. As such prior approval of the Engineer shall be obtained by the Contractor in each individual case.

6.03.02 Cleaning and Grubbing etc.

The area to be excavated shall be cleared out of fence, trees, logs, stumps, bush, vegetation, rubbish, slush etc. and levelled up. Trees up to 300 mm girth shall be up-rooted.

6.03.03 Excavation in Trenches

All excavation shall be done to the minimum dimensions as required for safety and working facility, wherever necessary and/or as directed by the Engineer, shoring - 'close' or 'open' type - shall be provided depending upon the nature of soil, the depth of trench and location of adjacent structures

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

already constructed. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of trenches and pits from collapsing.

The rough excavation may be carried up to a maximum depth of 150 mm above the final level. The balance shall be excavated with special care. If the excavation is done to a depth greater than that shown on the drawing due to the Contractor's fault, the excess depth shall be filled up to the required level at the latter's cost with cement concrete not leaner than 1:4:8 ordinary concrete or richer as directed by the Engineer.

The excavation must be carried out in the most expeditious and efficient manner.

6.03.04 Dewatering

All excavations shall be kept free of water. Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas. The Contractor shall remove by pumping or other means approved by the Engineer any water inclusive of rainwater and subsoil water accumulated in excavation and keep the trench dewatered until the installation and backfilling work are complete. All pumps, cables and other materials required for dewatering shall be arranged by the Contractor at his own cost.

6.03.05 Backfilling in trenches with earth

Earth used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken to small pieces or removed. Filling shall be done on the sides and on top of pipes in layers not exceeding 150 mm, watered (if required depending upon moisture content of the fill material), rammed and consolidated, taking care that no damage is caused to the pipe.

Here also, the fill should rise the same on each side and coincidentally be tamped in layers. As the backfilling is progressed, temporary bracings and struts supporting the shoring planks may be dismantled progressively. The ultimate removal of shoring planks shall only be done after the backfilling work on both sides of the pipe is complete.

Earth for backfilling may be obtained from :

- a) The excavated spoils being stacked at a suitable nearby place as directed by the Engineer.
- b) Some borrow pits at distance as specified by the Engineer.
- c) Stacks of excavated spoils left by other agencies.

The final surface shall be trimmed and levelled to proper profile as desired by the Engineer.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

6.03.06 Testing and Acceptance Criteria for Backfilling work

The degree of compaction required will be as per the stipulation laid down in IS:4701. The density of soil in field shall be determined in accordance with IS:2720 (Part-XXVIII) or IS:2720 (Part-XXIX). The work of backfilling will be accepted after the Engineer is satisfied with the degree of field compaction achieved. The Engineer at his discretion may ask the Contractor for performing the Standard compaction tests at some specified locations for determining the degree of compaction. The Contractor shall do the testing at some approved laboratory at his own cost and forward test results, in triplicate, to the Owner.

6.03.07 Disposal of Surplus Spoil

Surplus material from excavation, which is not required for backfilling, will be disposed of in designated disposal areas. The spoils shall be dumped in a systematic manner and spread in layers not exceeding 150 mm thick and consolidated with the help of compacting equipment.

7.00.00 **CIVIL WORKS**

All Plain and Reinforced Concrete work covered in this section shall generally conform to Specification for Cement Concrete (Plain & Reinforced) :

Volume VII unless noted otherwise.

8.00.00 **TESTING AND INSPECTION**

8.01.00 **Large Diameter Piping**

8.01.01 After complete pipe lines have been laid and joined, the same shall be tested hydrostatically as specified in Vol.-II A, for hydrostatic test pressure of circulating water piping, Auxiliary Cooling Water Piping.

8.01.02 All the longitudinal and circumferential welded seams shall be subjected to chalk and kerosene test prior to hydraulic testing of the complete pipe line. This shall be done at the presence of the Owner/Consultants. In addition to this, test coupons shall have to be provided for each longitudinal seams for mechanical tests (tensile and bend), if considered necessary by the Owner. The test coupons are to be broken in presence of the Owner. Contractor shall satisfy the Owner that work is being carried out in accordance with the specification drawings and other conditions. Owner shall have full access to the Contractor's working area.

8.02.00 **Performance Tests for Steel Storage Tanks**

8.02.01 Vertical Cylindrical Storage Tanks shall be tested generally as per IS:803 (latest edition) including the following :

a) Spot radiography if joint efficiency factor of 0.85 is specified.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- b) Bottom plate testing by air or vacuum box.
 - c) Shell testing by filling with water.
 - d) Fixed roof testing by air.
- 8.02.02 Horizontal cylindrical tanks manufactured in accordance with BS:2594 shall be tested hydraulically at 0.7 bar at the top of tank, unless otherwise specified.
- 8.02.03 Pressed steel tanks shall be hydraulically tested by filling with water up to the top of tank as per IS:804.
- 8.02.04 Radiography & hydrostatic tests shall be guided by IS:2825 for pressure vessels.
- 8.02.05 Hydraulic & other performance tests shall be conducted on all accessories of the tank as per applicable standard.
- 8.02.06 All tanks shall be leak tested twice, after completion of fabrication and after application of anti-corrosion painting/ lining. The tanks shall be filled up with water in stages as directed by the Engineer. The duration of leakage test shall not be less than eight (8) hours.
- 8.03.00 **Shop Inspection and Testing for Expansion Joints**
- 8.03.01 The manufacturer shall conduct all tests requirement to ensure that all the component parts of the Expansion Joints offered conform to the requirements of applicable codes and standards.
- 8.03.02 Dimensional inspection

Each Expansion Joint shall be inspected for dimensional accuracy acceptance limits of which shall be mutually agreed upon.
- 8.03.03 Hydrostatic pressure test & leakage test

All Expansion bellows shall be subjected to internal hydrostatic pressure test at a value of one and a half (1.5) times the design pressure for a period of 10 min. under each of the following conditions :

 - a) Free position of the bellow
 - b) With permitted (design) elongation & lateral deflections and
 - c) With design contraction and lateral deflection.

Inspection for leakage from the bellow shall be carried out during pressure test.

After the hydro test is over, the bellow shall be dimensionally inspected to check deformation, if any.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

During the test, the control assembly shall be suitably adjusted to obtain the test conditions of the bellow.

8.03.04 Vacuum Test

All Expansion Joints shall be subjected to vacuum test at a pressure of 700 mm of Hg for a period of 10 min. under each of the three conditions mentioned in clause 8.03.03 above.

8.03.05 Chemical Analysis

Test for chemical composition of the bellow material, split retaining ring, control rod assembly shall be carried out, if asked for in data sheets.

9.00.00 PAINTING
9.01.00 For Large Diameter Piping

9.01.01 Before application of the paint, the internal and external surfaces shall be thoroughly cleaned with wire brush or white metal blasting as per SA 2.0 standard as required for removal of loose dirt, mill scales etc. Manufacturer's recommendation shall strictly be followed in the application of paint.

9.01.02 Inner surface of each section of the pipe shall be given adequate number of coats of epoxy resin based red oxide primer paint or approved equal so as to achieve a dry thickness of minimum 0.8 mm. Inner surface painting shall be applied at the fabrication yard before laying the pipes in position, leaving about 200 mm at both ends for welding of joints. This portion shall be painted after completion of laying and jointing.

9.01.03 Outside surface of pipes and fittings including hangers and supports that will be overground or in a pit shall be given one (1) coat of red lead primer before despatch from fabrication yard. After installation, the part of the pipeline from where priming coat has been rubbed off shall be retouched with primer. Then two coats of Synthetic Enamel paint of approved quality and colour shall be applied.

9.01.04 Outside surface of buried pipes and fittings shall be provided with corrosion protection as follows :

Rapping coating shall be done conforming to AWWA-C-203/IS15337 or approved relevant codes/ standards. Contractor shall submit detailed protection procedure for approval.

9.01.05 The pipes that will be buried underground shall be spark tested after completion of wrapping of each sections/field jointing to check the quality of insulation that has been provided on the pipe.

9.02.00 Painting for Steel Storage Tanks

9.02.01 Surface preparation :Internal white metal blasting and external wire brushing.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

9.02.02	Primer -	i)	internal - epoxy based Zn rich primer
		ii)	external - Synthetic Red lead.
9.02.03	Finish Coat -	i)	internal - Coal tar epoxy
		ii)	external - Synthetic enamel
9.02.04	Outside of bottom surface shall have 3 coats of Bitumastic paints.		
10.00.00 DRAWINGS, CURVES & INFORMATION REQUIRED			
10.01.00	The Tenderer shall submit with his formal proposal the following besides the different information required elsewhere under this section of specification.		
10.01.01	Outline and fabrication drawings of the tanks indicating plate thickness, details of structural support, stiffeners and details of connections provided.		
10.01.02	Illustrative literature and drawings and the equipments supplied for the accessories supplied with tanks.		
10.01.03	General Arrangement and Sectional drawings with data on weight and material of construction for each category of Expansion Joints with control rod assemblies.		
10.01.04	A comprehensive write-up or brochure on the manufacturing and testing facilities in the shop of the manufacturer for rubber expansion joints.		
10.01.05	Complete technical details of each type of spring support. The Bidder shall also submit outline drawings showing the support arrangements indicating principal dimensions and weight of the supports. Whenever necessary, cross-sectional details shall be furnished showing the details of assembly of components and their material of construction.		
10.01.06	The Bidder shall clearly indicate for each type of support the number of spring used, rated load of springs, actual load to be carried, initial compression requirement, etc. The Bidder shall also indicate maximum and minimum spring compressions within which his design will permit spring movement for loaded and empty working conditions.		
10.02.00	After finalisation of contract, various drawings, data and instruction manual shall be submitted for review/approval of Owner and afterwards for final distribution in quantities following the procedure as set up in the applicable clauses in General Conditions of Contract.		
	The various drawings/data to be furnished shall include the following :		
10.02.01	Detailed fabrication drawing showing the sizes, materials and weld edge preparation etc. The fabrication drawings shall give all necessary information for fabrication; erection and painting of steel work in accordance with provisions of this specification. Welding symbols used shall be in accordance		

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

-
- with the requirements of IS:813 - latest revision and shall be consistent throughout. Weld lengths called on the drawings shall be net effective lengths.
- 10.02.02 Tenderer shall submit working drawing for excavation and backfilling purpose as mentioned earlier.
- 10.02.03 The Contractor shall also submit detailed calculations in support of the final pipe thickness adopted.
- 10.02.04 Instruction Manuals covering maintenance, repair and replacement of equipment fabricated and supplied by them.
- 10.02.05 Details of welding procedure and weld roots to be used.
- 10.02.06 Design calculations for plate thickness etc., considering all applicable loads, seismic effect, wind load etc.
- 10.02.07 Test procedures for tanks and test certificates.
- 10.02.08 General Arrangement drawing of each size and type of Rubber Expansion Joint with control rod assembly giving principal dimensions and weights.
- 10.02.09 Cross-sectional assembly drawing of each size and type of Rubber Expansion Joint complete with data on materials of construction, control rod assembly etc.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

ANNEXURE-I

SPECIFICATION OF MISCELLANEOUS STEEL TANKS

Sl. No.	Description	Shape	Size	Nominal Capacity (Cu.M) Minimum	Nos. Reqd.
1.	DM Water make up Tank in DM CW system	Horizontal Cylindrical With flat ends		5	1
2.	Potable water Tank	Rectangular/ Cylindrical with flat roof		50	1
3.	Service Water Tank	RCC Over head tank		300	1
4.	Condensate Storage Tank	Vertical		1000	1
5.	DM Water Storage Tank	Vertical		2000	2

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

ANNEXURE-II

CAST IRON BODY BUTTERFLY VALVE

1.00.00	Valve classification Code	: CIBF
2.00.00	Basic Design Code	: AWWA-C-504
3.00.00	Pressure	: To be suitably chosen by the Bidder according to requirement, but not less than class 75A as per AWWA-C-504.
4.00.00	Construction	: Cast Body and Disc
5.00.00	Material	
	a) Body	: 2% Ni Cast Iron as per IS-210 Gr. FG260 with 2% Ni.
	b) Valve Disc	: -Do-
	c) Valve Shaft	: Stainless Steel ASTM-A-479 type 304
	d) Seat ring	: Clamping ring Stainless Steel ASTM-A-479 type 304
	e) Shaft Bearing	: Ferrobestos LA-33
	f) Gland Packing	: Impregnated Teflon
	g) Seal	: Nitrile Rubber
6.00.00	End preparation	: Flanged, Drilled as per ANSI B16.1. Necessary counter flange nuts, bolts, gaskets are to be provided with each valve.
7.00.00	Testing	: As per AWWA-C-504. However valve disc strength for both forward reverse flow is to be carried out as per BS5155. Certificate for proof of design test for similar type of valve is to be furnished.

VOLUME : III-C

SECTION-VIII

GENERAL TECHNICAL REQUIREMENT
FOR
PIPING, FITTINGS AND VALVES

C O N T E N T S

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.00.00	INTENT OF SPECIFICATION	1 OF 34
2.00.00	SCOPE	1 OF 34
3.00.00	CODE & STANDARDS	2 OF 34
4.00.00	DESIGN, MANUFACTURE, FABRICATION AND ERECTION	6 OF 34
5.00.00	TESTS & INSPECTION	32 OF 34

SECTION: VIII

TECHNICAL SPECIFICATION FOR PIPING, FITTINGS & VALVES

1.00.00 INTENT OF SPECIFICATION

This specification covers the design, manufacturing, inspection, shop testing, erection, testing and commissioning at site of all the piping, fittings, valves and all other accessories as specified and as further required.

2. 00.00 SCOPE

The items & materials to be supplied shall include but not be limited to the following:

- 2. 01.00 Pipes, bends, elbows, tees, branches laterals, crosses, reducing unions, couplings, cap, expansion joints, flanges, blank flanges, saddles, shoes, sampling connections etc. necessary for making a reliable piping system.
- 2. 02.00 Gaskets, ring joint, backing rings, jointing material etc. as required.
- 2. 03.00 Instrument tapping connection, stub and thermowells.
- 2. 04.00 Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifice nozzles etc., pressure accumulators as necessary.
- 2. 05.00 Valves and Isolation Gates, to start/stop and control / regulate flow.
- 2. 06.00 Strainers.
- 2. 07.00 Anchor blocks (for buried / over ground piping), support brackets, clamps, support trestles, hangers, vibration dampener etc. for the piping under the scope of contract.
- 2. 08.00 Bolts, nuts, fasteners as required for interconnecting piping, valves and fitting as well as for terminal points.
- 2. 09.00 Steel for pipe supports and embedded steel. Also pipe supports and necessary embedment required to be embedded in concrete for underground / above ground pipes.
- 2. 10.00 Painting, anti-corrosive coatings, etc. inside and outside of pipes as necessary and as specified.
- 2. 11.00 All embedded parts required for all tanks/water retaining structures made of RCC including puddle pipes shall be supplied by the Bidder.

3. 00.00 CODE & STANDARDS

The design, manufacture, fabrication shop testing & inspection, erection, testing and commissioning of piping fittings and valves shall conform to the latest revisions of the following Indian / International codes / standards and other applicable statutory codes / ordinances, rules, regulations as well as safety codes, in addition to other codes / standards if any as addressed elsewhere in the Tender Specification.

Other National / International Standards may also be considered acceptable (subject to specific approval by Purchaser) with reference to any specific situation / requirement provided they are recognized to be equivalent or superior to the Standards as stipulated in the Tender Specification.

ANSI	-	B 16.5	:	Steel pipe flanges and flanged fittings.
ANSI	-	B 16.9	:	Wrought steel Butt welding fittings
ANSI	-	B 16.11	:	Forged steel socket welding and screwed fittings
ANSI	-	B 16.21	:	Non Metallic Gaskets for Pipe Flanges
ANSI	-	B 16.25	:	Butt welding ends
ANSI	-	B 16.28	:	Wrought Steel Butt Welding short radius elbows and returns
ANSI	-	B 31.1	:	Power Piping code.
ANSI	-	B 36.10	:	Welded & seamless wrought steel pipe
ANSI	-	B 36.19	:	Stainless steel pipe
API	-	5L	:	Specification for Line Pipe
ASME	-	Section II		Ferrous Materials Specification
ASTM	-	A 53	:	Seamless carbon steel.
ASTM	-	A 106	:	Grade C Seamless carbon steel pipe.
ASTM	-	F441 / F441M - 09	:	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM	-	F439 - 11	:	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

AWWA	-	C-203	:	Coal tar protective coatings and linings for steel water pipe lines - Enamel and Tape - Hot Applied
AWWA	-	C-208	:	Dimensions for Steel Water pipe fittings
AWWA	-	C-504	:	Standard for butterfly valve.
BS	-	1868	:	Specification for steel check valves (flanged and butt-welding ends) for the petroleum, petrochemical and allied industries
BS	-	5158	:	Specification for cast iron plug valves
BS	-	5353	:	Specification for steel plug valves
BS EN	-	593	:	Industrial valves. Metallic butterfly valves
BS EN	-	1796	:	Plastics piping systems for water supply with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)
BS EN	-	13397	:	Industrial valves. Diaphragm valves made of metallic materials
BS EN	-	13789	:	Industrial valves. Cast iron globe valves
BS EN	-	14364	:	Plastics piping systems for drainage and sewerage with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP). Specifications for pipes, fittings and joints
BS EN ISO	-	16138	:	Industrial valves. Diaphragm valves of thermoplastics materials
DIN	-	16966	:	Glass fibre reinforced polyester resin (UP-GRP) pipe fittings and joint assemblies - Requirements for and testing of bushes, flanges, and flanged and laminated joints
IS	-	210	:	Grey Iron Castings
IS	-	318	:	Leaded Tin Bronze Ingots and Castings
IS	-	458	:	Precast Concrete Pipes (with and without reinforcement).
IS	-	554	:	Pipe Threads where Pressure Tight-Joints are made on the Threads – Dimensions, Tolerances and Designation.

IS	-	778	:	Copper Alloy Gate, Globe and Check Valves for Waterworks Purposes.
IS	-	783	:	Code of Practice for Laying of Concrete Pipes.
IS	-	1239 Part 1	:	Steel Tubes, Tubulars and other Wrought Steel Fittings - Specification Part 1 Steel Tubes
IS	-	1239 Part 2	:	Specification Steel Tubes, Tubulars and other Steel Fittings Part 2 Steel Sockets Tubular and other Steel Pipe Fittings
IS	-	1363	:	Hexagon Head Bolts, Screws and Nuts of Product Grade C.
IS	-	1364	:	Hexagon Head Bolts, Screws and Nuts of Product Grades A and B.
IS	-	1367	:	Technical Supply Conditions for Threaded Steel Fasteners.
IS	-	1536	:	Indian Standard for Centrifugally Cast (Spun) Iron Pressure Pipes for Water, Gas and Sewage.
IS	-	1537	:	Vertically Cast Iron Pressure Pipes for Water Gas and Sewage.
IS	-	1538	:	Cast Iron Fittings for Pressure Pipes for Water, Gas and Sewage.
IS	-	1703	:	Water Fittings - Copper Alloy Float Valves (Horizontal Plunger type)
IS	-	1879	:	Malleable Cast Iron Fittings
IS	-	2016	:	Plain washers
IS	-	2062	:	Hot Rolled Low, Medium and High Tensile Structural Steel.
IS	-	2629	:	Recommended practice for Hot dip galvanising of iron and steel
IS	-	2633	:	Method for testing uniformity of coating on zinc coated articles.
IS	-	2379	:	Colour Code for Identification of Pipe Lines.

IS	-	2685	:	Code of Practice for Selection, Installation and Maintenance of Sluice Valves.
IS	-	2712	:	Gaskets and Packings- Compressed Asbestos Fibre Jointing.
IS	-	2825	:	Code for Unfired Pressure Vessels.
IS	-	3006	:	Chemically Resistant Glazed Stoneware Pipes and Fittings.
IS	-	3042	:	Single Faced Sluice Gates (200 to 1200 mm size).
IS	-	3114	:	Code of Practice for Laying of Cast Iron Pipes.
IS	-	3589	:	Steel Pipes for Water and Sewage (168.3 to 2540 mm Outside Diameter).
IS	-	4038	:	Foot Valves for Waterworks Purposes.
IS	-	4682 (Part I)	:	Code of practice for lining of vessels and equipment for chemical - rubber lining.
IS	-	4736	:	Hot-dip Zinc Coatings on Mild Steel Tubes.
IS	-	4984	:	High Density Polyethylene Pipes for Potable Water Supplies.
IS :	-	4985	:	Unplasticized PVC Pipes for Potable Water Supplies.
IS :	-	5312	:	Swing Check Type Reflux (non-return) Valves for Water Works Purpose.
IS :	-	5822	:	Code of practice for laying of electrically welded steel pipes for Water supply.
IS :	-	8062	:	Code of practice for cathodic protection (Part-II) of steel structure
IS :	-	10221	:	Code of practice for coating and wrapping of underground mild steel pipes
IS :	-	14846	:	Sluice Valve for Water Works Purposes (50 to 1200 mm Size).

4. 00.00 DESIGN, MANUFACTURE, FABRICATION AND ERECTION

4.01.00 The piping system, fittings and accessories supplied shall conform to high standards of engineering, design, workmanship and be capable of performing in continuous commercial operation in a manner acceptable to Purchaser.

4.02.00 All the piping systems, fittings and accessories supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 25 years and shall withstand the operating parameter fluctuations and cycle variations which can be normally expected during this period.

4.03.00 Material of construction for pipes under different services shall be as below:

Service	Recommended Material of Construction
River Water	Carbon Steel
Clarified Water	Carbon Steel
Filtered Water	Carbon Steel (inside rubber lined)
Degassed Water	Carbon Steel (inside rubber lined)
Demineralised Water	Carbon Steel (inside rubber lined)
Service Air	Galvanized Steel
Instrument Air	Stainless Steel (schedule 40)
Potable Water	Galvanized Steel
Chlorine (liquid under pressure)	Seamless Carbon Steel (schedule 80)
Chlorine (dry gaseous under pressure)	Seamless Carbon Steel (schedule 80)
Chlorine under vacuum	CPVC (schedule 80)
Chlorine in water	CPVC (schedule 80) / Carbon Steel (inside rubber lined)
Sodium Hydroxide Solution	CPVC (schedule 80) / Carbon Steel (inside rubber lined)
Alum Solution	CPVC (schedule 80) / Carbon Steel (inside rubber lined)

Service	Recommended Material of Construction
Lime Solution	Galvanized Steel
Polyelectrolyte Solution	CPVC (schedule 80) / Carbon Steel (inside rubber lined)
Hydrochloric Acid (concentrated)	Carbon Steel (inside rubber lined)
Hydrochloric Acid (dilute)	Carbon Steel (inside rubber lined)
Sodium Hydroxide (concentrated)	Carbon Steel (inside rubber lined)
Sodium Hydroxide (dilute)	Carbon Steel (inside rubber lined)
Sulfuric Acid Solution (concentrated)	Carbon Steel
Sulfuric Acid Solution (dilute)	Carbon Steel (inside rubber lined)
Scale Inhibitor Solution	Stainless Steel (schedule 40) / CPVC (schedule 80)
Corrosion Inhibitor Solution	Stainless Steel (schedule 40) / CPVC (schedule 80)
Biocide Solution	Stainless Steel (schedule 40) / CPVC (schedule 80)
Filter Backwash Wastewater	Carbon Steel
Ammonia Solution	Seamless Stainless Steel (304 grade)
Hydrazine Solution	Seamless Stainless Steel (304 grade)
Oxygen Line	Aluminum
Crude Condensate	Carbon Steel (inside rubber lined)
Treated Condensate	Carbon Steel (inside rubber lined)
Demineralized Water with ion exchange resins	Stainless Steel (304 grade)
Non Oily Sludge	Cast Iron (underground) Carbon Steel (overground)
Neutralized Wastewater	Carbon Steel (inside rubber lined)

Cooling Tower Blowdown	Carbon Steel
Boiler Blowdown	Carbon Steel
Crude Oily Wastewater	Seamless Carbon Steel
Treated Oily Wastewater	Seamless Carbon Steel
Rainfall Runoff	Carbon Steel
Equalized Wastewater	Carbon Steel
Oily Sludge	Seamless Carbon Steel

The portion of pipe lines at the downstream of isolation valves, conveying flushing water shall be of the material & type same as those of the pipelines which are being flushed.

4.04.00 Material & Dimensional Standards for Piping and Fittings

4.04.01 The welded Carbon Steel Pipes shall conform to the following codes / standards:

Pipes	Material Code / Standard	Dimension Code / Standard
50 mm NB and below	Mild Steel, ERW, IS-1239 Part-1 / ASTM-A 53 Grade B (Welded), Type-E, Schedule 80.	IS-1239 Part-1. Plain ends for Socket Welding.
65 mm to 150 mm NB	Mild Steel, ERW, IS-1239 Part-1 / ASTM-A 53 Grade B (Welded), Type-E, Schedule 40.	IS-1239 Part-1. Bevelled ends for Butt Welding.
200 mm to 450 mm NB	Mild Steel, ERW, IS-3589 Grade Fe 410 / ASTM-A 53 Grade B (Welded), Type-E, Schedule 40.	IS-3589. Bevelled ends for Butt Welding.
500 mm NB and above	Rolled and Butt Welded from IS-2062 Grade A plates or SA-285 Grade C or Equivalent (subject to approval by Purchaser). / Spiral Welded pipes.	IS-3589. Bevelled ends for Butt Welding.

Elbows (R=1.5 D)	Material Code / Standard	Dimension Code / Standard
50 mm NB and below	Forged carbon steel from ASME-SA 105 / Carbon Steel to IS-1239 Part-2 (Heavy grade).	SW ends to ANSI-B 16.11 (3000#) / IS-1239 Part-2.
65 mm to 150 mm NB	ASME-SA 234 Grade WPB / Carbon Steel to IS-1239 Part-2 (Heavy grade).	BW ends to ANSI-B 16.9 / IS-1239 Part-2.
200 mm to 350 mm NB	ASME SA-234 Grade WPB	BW ends to ANSI-B 16.9 / IS-1239 Part-2.
Mitre Bends (R=1.5 D)	Material Code / Standard	Dimension Code / Standard
400 mm NB and above	Fabricated from parent pipe.	ANSI-B 31.1 / AWWA-C 208. 90° - 3 cut, 4 piece constructions. 45° - 2 cut, 3 piece constructions.
Tees	Material Code / Standard	Dimension Code / Standard
50 mm NB & below	Forged Carbon Steel to ASME-SA 105 / ASME-SA 234 Grade WPB / Carbon Steel to IS-1239 Part-2 (Heavy grade).	SW ends to ANSI-B 16.11 (3000#) / IS-1239 Part-2.
65 mm to 150 mm NB	ASME-SA 234 Grade WPB / Carbon Steel IS-1239 Part-2 (Heavy grade).	BW ends to ANSI-B 16.9 / IS-1239 Part-2.
200 mm NB and above	ASME-SA 234 Grade WPB / Fabricated from parent pipe.(set in / set on type).	ANSI-B 16.9
Reducers	Material Code / Standard	Dimension Code / Standard
50 mm NB & below	Forged carbon steel to ASME-SA 105 / ASME-SA 234 Grade WPB / Carbon Steel to IS-1239 Part-2 (Heavy grade).	SW ends to ANSI-B 16.11 (3000#) / IS-1239 Part-2.
65 mm to 150 mm NB	ASME-SA 234 Grade WPB / Carbon Steel to IS-1239 Part-2 (Heavy grade).	BW ends to ANSI-B 16.9 / IS-1239 Part-2.

200 mm NB and above	ASME-SA 234 Grade WPB / Fabricated from parent pipe.(set in / set on type)	ANSI-B 16.9
Slip On Flanges / Blind Flanges	Material Code / Standard	Dimension Code / Standard
All sizes	IS-226 / IS-2062 Grade A / ASME-SA 105 / ASTM-A 216 Grade WCB. Flanges shall be either machined or forged from plate / casting.	Dimensions / Drilling as per ANSI-B 16.5, Pressure rating 150# / 300# or otherwise as applicable, generally Flat face.
Bolts & Nuts	Material Code / Standard	Dimension Code / Standard
All sizes	IS -1367 CI 4.6 for bolts IS-1367 CI 4 for nuts	IS -1367
Gaskets	Material Code / Standard	Dimension Code / Standard
All sizes	3 mm thick wire reinforced rubber. Material shall contain no asbestos.	ANSI-B 16.21.

- 4.04.02 Seamless Carbon Steel Pipe shall conform to ASTM-A 106 Grade C (Schedule 80) / ASTM-A 53 / API 5L. Fittings shall conform to applicable codes / standards and be in conformity with the code / standard for the parent pipe.
- 4.04.03 Galvanized Steel Pipes and Fittings shall conform to the clause 4.02.01 above and be galvanized to IS-4736. Ends of all fittings will however be screwed as per IS-554. Mitre Bends shall not be used. Pipe joints shall be screwed for lower size and flanged for higher size. No hot work on G.I. pipes shall be done. Flanges shall be screwed and hot dipped galvanized.
- 4.04.04 Pipes and Fittings which shall be rubber lined, need to conform the clause 4.02.01 above. The inside surfaces of the items shall be completely debanded and made suitable for lining. The items will be inside rubber lined with 3 mm thick (minimum) natural rubber in two layers as per IS-4682. Flanges shall be flat face as per ANSI-B 16.5 and full face rubber lined. Pipe to Pipe joint will be flanged only. For small size fittings, SS-316 fittings shall be used if rubber lined carbon steel fittings are not available.
- 4.04.05 Stainless Steel Pipe shall conform to ASTM-A 312 of specified grade (Schedule 40) with dimensions as per ANSI-B 16.39. Fittings shall conform to applicable codes / standards and be in conformity with the code / standard for the parent pipe. Mitre Bends shall not be used. Elbows / Tees / Reducers shall be of Forged Stainless Steel (ASME-SA 182) with SW ends to ANSI-B 16.11 (3000#).

- 4.04.06 Cast Iron pipes shall conform to IS-1536. Fittings shall conform to applicable codes / standards and be in conformity with the code / standard for the parent pipe.
- 4.04.07 PVC Pipes shall conform to IS-4984 Class 4. Fittings shall conform to applicable codes / standards and be in conformity with the code / standard for the parent pipe.
- 4.04.08 High density Polyethylene Pipes shall conform to IS-4984 Class 5. Fittings shall conform to applicable codes / standards and be in conformity with the code / standard for the parent pipe.
- 4.04.09 CPVC pipe (Schedule 80) shall be produced from compounds which conform to and are specified in ASTM-D 1784. CPVC Pipe shall be manufactured in strict compliance with ASTM-F 441. Pressure-Rated CPVC Pipe shall be manufactured in strict compliance with ASTM-F 442. All CPVC piping shall be manufactured from NSF approved compounds and NSF Listed for potable water use. CPVC Fittings (Schedule 80) shall be as per ASTM-F 437 and F 439.
- 4.04.10 Pipe lines carrying water, chemicals, air etc. shall be sized generally based on the following ranges of velocities. However pipe size if any for any particular service is addressed in the Tender Drawings / Data Sheets, the selected size for the applicable service shall not be less than the specified size.

Pipe Size	Velocity in m/sec		
	Below 50 mm	50 mm - 150 mm	200 mm & above
Pump Suction for Water		1.2 - 1.5	1.2 - 1.8
Pump Discharge for Water	1.2 - 1.8	1.8 - 2.4	2.1 - 2.5
Header		1.5 - 2.4	2.1 - 2.4
Compressed air below 2 Kg/cm ² (g)	15 - 20	20 - 30	25 - 35
Compressed air 2 Kg/cm ² & above	20 - 30	25 - 40	35 - 45
Suction to compressor/ Blowers		7 - 8	
Pump Suction for Chemical Solution	1.0 - 1.2	1.1 - 1.3	
Pump Discharge for Chemical Solution	1.2 - 1.4	1.3 - 1.5	

- 4.05.00 Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

- 4.06.00 The following "C" Value shall be used in WILLIAM & HAZEN formula for calculating the friction loss in piping and fittings.

i)	Carbon Steel Pipe	:	100
ii)	C.I Pipe	:	100
iii)	Carbon Steel Pipe (inside rubber lined)	:	120
iv)	PVC / HDPE / GRP / CPVC pipes	:	140

For calculating the pump head, atleast 10% margin shall be taken over the pipe friction losses.

- 4.07.00 Piping Layout

- 4.07.01 Piping shall be grouped together as far as practicable and routed to present a neat appearance and orientation. All piping shall generally be installed perpendicular or parallel to the major equipment, building structure and floor. Pipe routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of other equipment. Piping shall be routed to avoid interferences with other pipes, hangers, structures, equipment electrical trays, HVAC ducts etc. Convenient supporting points, adequate flexibility for thermal expansion and neat appearance shall be considered in piping layout work.

- 4.07.02 Provision shall be made while preparing piping layout to accommodate all system accessories such as valves/ expansion bellows/instrument stubs/instruments/ specialties as per P&ID.

- 4.07.03 All local instruments on the pipeline shall be located such that the reading can be observed without inconvenience.

- 4.07.04 Overhead indoor piping shall have a vertical clearance of minimum 3.0 m above finished floor level of working areas / walkways. Overhead outdoor piping shall have a vertical clearance of minimum 4.0 m above finished ground level and minimum 7.5 m above finished road level unless addressed otherwise elsewhere in this specification. When several pipe lines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.

- 4.07.05 In specific cases (subject to instruction by Purchaser for any site specific reason), pipes may be routed overground on RCC pedestals with bottom of pipes minimum 300 mm above finished ground level.

- 4.07.06 Pipe, when specifically addressed, shall be laid in trenches or buried. All buried pipes in general shall be laid with the top of the pipe 1.2 m to 1.5 m below the finished ground level unless mentioned otherwise. Full length of buried piping shall be provided with 100 mm thick sand bed.

- 4.07.07 Openings provided to accommodate pipelines must be closed with bricks and mortar with 10 mm to 12 mm clearance between brick work and pipe. The clear space must

be filled with felt or approved filling compound. The details of wall sealing arrangement shall be approved by Purchaser.

4.07.08 Drains shall be provided at low points and at pockets in piping such that complete drainage of system is possible. Vent connections shall be provided at high points where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vents shall not be less than 15 mm size. Plugs / cocks required for vent/drain system shall form part of the piping system and shall be supplied by Bidder as per finalized flow diagram. All vent valves & drain valves shall be arranged with easy reach of operation. All pipelines shall be given proper slope towards the drain points.

4.07.09 To facilitate dismantling of piping at the valves and equipment, break up flange/unions shall be provided. The location shall be decided as per the system requirement during detailed engineering.

4.08.00 Line Joints

Line Joints shall be envisaged as follows:

CS and SS pipes	:	Welded (socket welded for 50 mm NB & below & butt welded for 65 mm NB and above)
Galvanized Pipes	:	Screwed
Rubberlined Pipes	:	Flanged

4.08.01 Welded joints

For making welded joints (socket weld or butt weld) the welding shall be performed by manual shielded metal arc process. Any welder employed for carrying out welding shall be qualified as per ASME-Section IX for the type of joints to be welded. Jointing by butt weld or socket weld shall depend upon the respective piping material specification.

For Stainless Steel piping atleast the root run shall be welded with Tungsten Inert Gas (TIG).

Butt welding edge preparation shall be done as per ANSI-B 16.25.

All welding electrodes and welding rods including special ones, if any shall be furnished by the Bidder.

4.08.02 Screwed joints

Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI-B 2.1 (taper) NPT / IS 554, unless specified otherwise.

Teflon tapes shall be used to seal screwed joints and it shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease (with appropriate

solvent if necessary) and dried before applying the sealant. Pipe ends shall be reamed or filed out to size of bore and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe as well as the flange shall be refaced accurately.

4.08.03 Flanged joints

All flanges and flange drilling shall be to ANSI-B 16.5 of applicable pressure/temperature class. However in case of interface with the pipe of Purchaser, the flange/interconnection details shall be designed to match the applicable interface piping and concerned details.

When weld neck or socket weld flanges are used, their bore must be made the same as that of the pipe being welded to. Socket welded or threaded flanges may be used, with the appropriate piping system for connection of pipe to the flanged equipment.

Drilling of flanges on piping must match with the drilling of flanges on the valves /equipments to which the piping is to be connected.

While fitting the mating flanges, care shall be taken to properly align the pipes and to check the flanges to trueness so that the faces of the flanges can be pulled up together without producing any stress on the adjacent pipes and equipment flanges.

Flanges shall be generally Slip-On / Blind Flat Face type. The packing ring or gasket of the flanged joint shall be of full face type. Flanged joints shall not be buried.

4.08.04 With reference to maintenance for carbon steel pipes, three piece socket welded unions for sizes 50 mm NB and below shall be used. For higher sizes, flanged joints shall be used.

4.09.00 Fabrication of Pipes

4.09.01 General Requirements

The Bidder shall prepare necessary fabrication drawings based on approved piping layouts.

Flanges and their contact surfaces shall be concentric with the pipe axis and shall be accurately machined and drilled true to template.

Where welded pipe and fittings are used, the longitudinal weld seams of adjoining sections shall be staggered by 90 degree.

Prefabrication shall be carried out in the fabrication shop to ensure quality of work and to minimize work on the field.

Where fabricated reducers have been specified, they shall be fabricated from parent pipes by the 'cut and shut' method.

All bends, tees and reducers shall be fabricated as per the latest edition of power piping code, ANSI-B 31.1 or approved equivalent. Reinforcement wherever required, shall be provided.

Only shop fabricated mitre bends or mitre fittings shall be acceptable. Mitre bends will not be accepted for steel pipes of 350 NB and below. For sizes 400 mm NB and above, the mitre bends shall conform to BS-534.

For easy handling & removal of equipment, valves etc. and for maintenance purpose, break up flanges shall be provided for 65 mm NB and above. For flanged joints of 50 mm NB and below, suitable type of compression flexible coupling shall be provided.

4.09.02 Rolled and Welded /Spiral Welded Pipes

Pipes of larger diameter shall be fabricated from steel plates conforming to IS-2062 by rolling and welding or spiral welded pipes shall be used.

Where pipe lengths need to be erected before the circumferential joints is welded, the pipe ends at these joints shall be beveled so that the top half is welded mostly from outside and the bottom half mostly from inside of pipe.

Beveled (single V / double V) ends shall be provided for butt welding as per Welding Procedure Specification.

4.09.03 Fabrication of flanges for large diameter pipes (sizes 600 mm NB and above)

Flanges fabricated from plates shall conform to AWWA-C 207 / BS-4504 / ANSI-B 16.47.

All welds in fabricated flanges shall be subjected to 10% radiographic examination.

Flanges shall be flat faced machined to 10 microns surface finish. Back face of the flanges shall also be machined to 25 microns surface finish.

Inspection holes shall be provided at suitable locations for pipes 800 mm NB and above as required for periodic observations and inspection purposes.

4.09.04 Rubber Lined Pipes

All rubber lined pipes shall be seamless or bead removed ERW pipes. Inside surface of the pipes shall be completely cleaned and made suitable for lining.

All rubber lined pipes shall have flanged joints. Pipes shall be welded with flanges before rubber lining.

For rubber lined pipe, natural rubber lining should be applied in two (2) layers on the inside surface of pipes, giving a total thickness not less than 3 mm. Surface hardness of rubber lining shall be 65 ± 5 Shore A class.

4.09.05 Welding

Welding shall be carried out by manual shielded metal arc and Tungsten Inert Gas

Welding process. Electrodes used shall be of Purchaser approved make. Electrodes shall be kept dry and electrode containers shall be protected against moisture. Electrodes that show sign of deterioration or damage shall not be used. Automatic or semiautomatic welding shall be done with the specific approval of Purchaser.

The Bidder shall submit procedures for welding, stress relieving, dye penetrant testing radiography etc. for prior approval of the Purchaser.

Weld shall not be made in pipe bends.

4.10.00 Supports for Overground Pipe

4.10.01 Complete supporting system for the pipe line shall be designed, fabricated and supplied by the Bidder. Inside the building, the overhead portion of the pipe line may be supported from the building structures. No support shall be taken from the brick wall. Outdoor pipes shall run on steel trestles wherever required. All the steel structure for the pipe rack and the supporting posts/trestles along with all necessary hangers, clamps, connecting steel, fixing bolts, nuts etc. shall be supplied and erected by the Bidder.

4.10.02 Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipe line movements as necessary. All guides, anchors, braces, dampener, expansion joint and structural steel to be attached to the building/structure, trenches etc. shall be provided. Type of hangers and components for all piping shall be selected and approval obtained from the Purchaser.

4.10.03 The supports shall meet the general guidelines indicated in the following code / standards:

MSS-SP 58	:	Pipe hangers & supports - Materials, design and manufacture.
MSS-SP 69	:	Pipe hangers & supports Selection and application.
ANSI-B 31.1	:	Power Piping Codes

4.10.04 Bidder shall locate, design, fabricate, supply and erect all supports, restraints and anchors required for supporting of over ground portion of piping under this contract

4.10.05 Support drawings for piping shall be got approved from the Purchaser. BOM for each support shall also be submitted.

4.10.06 All material for supports shall be of tested quality.

4.10.07 All structural steel required for supports shall be provided by the Bidder at no extra cost to the Purchaser.

4.10.08 All pipe supporting element, guides, sliding support, beams, channel section, attachment to supports, beam clamps etc. shall be provided by the Bidder.

4.10.09 Support locations will be shown in the layout drawing to be submitted by the Bidder.

4.10.10 Fabrication, supply and installation of brackets, pipe shoes, saddles etc. shall be

- included in the scope of Bidder and the same shall be carried out as per approved drawings.
- 4.10.11 If an outdoor saddle support is assumed to permit sliding movement of piping over the support, consideration shall be given in selection of supporting material at the interface so that no rust formation takes place and the actual sliding movement is feasible in practice.
- 4.10.12 All pipe supports shall be designed to fully sustain the pipe in normal operating position, allow free and ample expansion or contraction except where anchored and prevent excessive stress.
- 4.10.13 Sway braces, cushioned clamps or other vibration control equipment shall be used in order to prevent unwanted movements of the piping due to vibration, shock or other causes. These shall be of such design as to protect piping against these movements regardless of direction.
- 4.10.14 The supports shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.
- 4.10.15 All piping supports shall be designed to avoid interference with other piping hangers, electrical conduits equipment and structures etc.
- 4.10.16 Saddles, supports etc. shall be capable of carrying the sum of all concurrent acting loads and shall be fabricated from plates/pipes sections conforming to SA 53 / IS-2062 or equivalent. They shall be designed to provide the requirement of supporting effects and allow pipe line movements as necessary. The structural work shall be as per IS-800 / BS-4360.
- 4.10.17 The maximum spans of the supports of straight lengths shall not exceed the recommended values indicated in ANSI-B 31.1. The spans shall be suitably reduced considering the following:
- a) Point loads due to valves and specialties, branch lines etc.
 - b) Pipe bends
 - c) Structural Steel beams.
 - d) Facilities for maintenance of flanged joints.
 - e) Minimum loads on equipment.
- 4.10.18 All vertical lines shall be properly supported on the vertical run and additionally provided with adequate number of lateral-restraints where the length of vertical run exceeds 5M.
- 4.10.19 At all sliding surfaces of restraints and supports Bidder shall provide a teflon lining to minimize sliding friction.
- 4.10.20 Pipe clamps shall have a minimum thickness of 5 mm for indoor piping and 6 mm for outdoor piping.
- 4.11.00 Erection

- 4.11.01 The Bidder shall coordinate the erection of the piping system as required with the erection schedule of other concerned systems. The sequence of work shall be carefully planned to minimize interference with other groups working in the same area. The actual sequence to be followed shall be to the approval of Purchaser who may at any time, direct the Bidder to reschedule his work as per the status of work site
- 4.11.02 Prior to making interface connections with equipment / system supplied by others, the Bidder shall obtain the approval of the concerned authority.
- 4.11.03 All workmanship shall be accomplished using accepted methods and procedures of the highest recognized fabrication and erection code / standards. Workmanship not conforming to the intent of this specification shall be liable to rejection by the Purchaser at any time, during the progress of work. The Bidder shall correct the workmanship immediately at no extra cost to the Purchaser.
- 4.11.04 The Bidder shall make all interface joints of the piping system, covered under this specification at the connecting points with equipment/piping supplied by others.
- 4.11.05 It is the responsibility of the Bidder to ensure correct orientation of all valves, instrument stubs etc. in line with final piping drawings.
- 4.11.06 The Bidder shall utilize the existing structures if any, to support the piping as far as practicable. All auxiliary steels required shall be supplied by the Bidder.
- 4.11.07 Before performing any welding, all corrosion products, dust, grease and other foreign material shall be cleaned from the surfaces to be joined.
- 4.11.08 Piping on both sides of the joint shall be adequately supported during all welding. Temporary supports, if used shall be so designed that no stress due to pipe weight comes on the joints during the joining.
- 4.11.09 All pipes shall be located and laid in accordance with the approved layout drawings. No deviation will be allowed unless written consent is issued by Purchaser in specific case(s).
- 4.11.10 Before laying the pipes, the coordinates and levels of the pipes shall be checked by the Bidder. Any discrepancies between the execution and approved drawings shall be brought to the notice of the Purchaser and corrections shall be carried out as per his instructions.
- 4.11.11 During erection of piping, the Bidder shall provide proper number and size of bolts and nuts as per drawings and specification. The Bidder shall provide approved quality of grease mixed with graphite powder thoroughly on all the bolts, nuts and washers immediately after erection and when the flange joints are dismantled for flushing, testing and alignment of equipment etc. to prevent rusting of nuts, bolts and gaskets. The grease and graphite powder shall be supplied by the Bidder
- 4.12.00 Cleaning and Flushing
- The exterior and interior surface of all piping shall be thoroughly cleaned of all sand, mill scale, grease, oils, dirt and other foreign materials. After cleaning, the interior surfaces of all piping shall be thoroughly blown dry and protected with a completely

water soluble preventive coating.

Flange faces shall be coated with an easily removable rust preventive coating.

Machined surface shall be coated with rust preventive paint. The paint shall be consumable in the welding process.

4.13.00 Pipes and Fittings if any, coming under purview of IBR, should meet its requirements and getting the approval from IBR in respect of the same shall be under the scope of the Bidder.

4.14.00 Valves & Isolation Gates

Valves will be used to start/stop or control flow.

All valves, shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required. The valves shall be of standard pressure rating as per the applicable code/ standard. The pressure rating of diaphragm valves shall be selected considering the maximum expected operating differential pressure. Sample valves will be used in sample collection lines.

Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too.

For location and type of Valves / Isolation Gates, Bidder need to refer to the P&I drawings enclosed with this specification.

4.14.01 Sluice / Gate Valves (for river water / clarified water / filtered water / similar application)

Sluice / Gate valve shall conform to IS-14846 PN1.6 minimum. Stem, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS-14846. Valves shall be of outside screw and rising stem type. Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (minimum) piping flanges.

Sluice / Gate valves for sizes 50 mm NB and below shall conform to IS-778 Class-2 / ANSI-B 16.34 straight, rising stem; with outside screw.

Sluice / Gate valves shall be provided with the following accessories in addition to the standard items.

- a) Hand wheel
- b) Gear Reduction Unit Operator for valves 250 mm NB and above.
- c) Bypass valve for valve of sizes 300 mm NB and above.
- d) Draining / Flushing arrangement wherever required.
- e) Arrow indicating flow direction.
- f) Position indicator.

Sluice / Gate Valves shall be provided with back seating bush to facilitate gland renewal during full open condition.

For lower sizes, the gate valves will be screwed bonnet with outside screw rising stem as per IS-778. The material of construction will be gun metal body, with brass stem and trim. Ends will be screwed to ANSI-B 2.1.

Gate valve on galvanized iron pipe shall be gun metal construction as per IS-778 Class 2. Ends will be screwed to ANSI-B 2.1.

4.14.02 Butterfly Valves (for river water / clarified water / filtered water / similar application)

Butterfly valves shall be of double flanged or lugged wafer type of low leakage rate conforming to AWWA-C 504 class 150 (min.) or BS-5155 PN 10 / class 150 (minimum)

The various components of butterfly valves shall be of the following:

i)	Body	:	Cast Iron – ASTM-A 48 Cl.40; BS-1452 Grade220 SG Iron – BS-2789. Cast Iron IS-210 Grade FG 260 Cast Steel – ASTM-A 216 Grade WCB; BS- 1504 or Equivalent grade (subject to approval by Purchaser).
ii)	Disc	:	Cast Iron – ASTM-A 48 Cl.40; BS-1452 Grade220 SG Iron – BS-2789. Cast Iron IS-210 Grade FG 260 Cast Steel – ASTM-A 216 Grade WCB; BS-1504 or Equivalent grade (subject to approval by Purchaser).
iii)	Shaft	:	ASTM-A 296 Grade CF 8M / AISI 316; AISI-420; BS-970 Grade 316; BS-970 Grade 420 S45.
iv)	Seat rings	:	Nitrile rubber, EPDM (Ethylene propylene rubber), Hypalon.

Butterfly valves shall be fitted with sleeve type bearing such as PTFE. Valves of size 350 mm NB and above shall be provided with one or two thrust bearings to hold the disc securely in the centre of valve seat without hydraulic or external axial shaft loads. Sleeve and other bearings fitted into the valves body shall be of self lubricated materials that do not have any effect on the fluid handled and other components of the valves.

All the butterfly valves shall be provided with Hand wheel or lever/wrench operated as per the requirements.

The use of lever operators shall be limited to valves requiring a maximum of 90 degree stem rotation from full open to full closed position. For lever/wrench operated valves, means shall be provided for positively holding the disc in not less than three intermediate positions

For larger sizes i.e. 150 mm NB and above, hand wheel shall be provided.

Manually operated valves shall be provided with reduction gear unit for valves of size 250 mm NB and above. Valve provided with motorised or pneumatic actuator shall be provided with a hand wheel for manual operation.

All the valves shall be equipped with adjustable mechanical stop-limiting devices to prevent over travel of the valve disc in the open and closed positions. The valve operators (Handwheel or Gear reduction unit or Motor actuator etc.) shall be designed as per applicable International Standard.

All the butterfly valves shall be provided with an indicator to show the position of the disc.

Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (minimum) piping flanges.

4.14.03 Butterfly Valves (for decaionized water / deanionized water / demineralized water / desalinated water / similar application)

The butterfly valves shall conform to the requirements addressed under Cl. No. 4.14.02 above along with the requirements delineated below:

- a) Body shall be lined (minimum 3 mm) with natural rubber, ebonite, polypropylene or PVDF.
- b) Disc shall be either lined with PVDF, polypropylene, or natural rubber or shall conform to ASME-SA 479 Grade 316.

4.14.04 Ball Valves (for river water / clarified water / filtered water / similar application)

Ball valves may be used for sizes 40 mm NB and below. Ball valves shall conform to the following technical specifications:

a)	Design Standard	BS:5351
b)	Type	Screwed / Welded / Flanged ends; Full Bore: Split Body & Seat supported construction
c)	Material of Construction	
	Body	Carbon Steel to ASME-216 WCB / Cast Iron to IS-210 Grade 220 or better.
	Ball	Stainless steel ASME-SA 479 Grade 316 or 410.
	Seat ring	PTFE
	Stem	Stainless steel ASME-SA 479 Grade 304 or 316 or 410.
	Seats	Nitrile rubber; PTFE

- d) Valves shall be designed to be directly operable by a wrench / hand lever.

- e) Suitable stops shall be provided for both the fully open & close condition.
- f) All the valves shall be provided with an indicator for showing the position of the ball port.
- g) Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (minimum) piping flanges

4.14.05 Globe Valves (for river water / clarified water / filtered water / similar application)

Globe valves shall conform to the following technical specifications:

For sizes 50 mm NB and below

- i) Design Standard : IS-778 Class-2 / BS-1873
- ii) Type : Straight, rising stem, with outside screw.
- iii) Material of Construction

i)	Body, Bonnet, Stuffing Box & seat rings	Leaded Tin Bronze conforming IS-318 Grade 2
ii)	Stem	Stainless Steel, AISI-316
iii)	Disc	IS-318 Grade 2/AISI-316

Note: However, valves in the flushing water lines shall be of type and material specified for the chemicals which are being flushed by the line.

For sizes above 50 mm NB

- i) Design Standard : BS-13789 PN 10 (minimum).
- ii) Type : Double Flanged or wafer body, outside screw and rising stem type.
- iii) Material of construction

a)	Body	: Cast iron: IS-210 Grade FG260 / BS-1452 Grade14.
b)	Stem	: Stainless steel AISI-410 / 13% chrome steel.
c)	Disc	: Cast iron IS-210 Grade 260 / BS-1452 Grade 14.

d)	Packing	:	PTFE
e)	Seat & seat rings	:	13% chromium steel
f)	Gland & gland nut	:	AISI-420
g)	Hand wheel	:	Cast Iron or Malleable Iron

- iv) Back seat shall be provided on the stem or on the disc.
- v) Renewable disc assembly shall consist of disc holder, disc, disc guide, check nut and disc retaining nut with washer.
- vi) Disc of globe valve may be provided with renewable rubber seating ring.
- vii) Handwheels shall be marked with the word. OPEN or SHUT with arrow to indicate direction of opening or closing.

Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (minimum) piping flanges

Globe valve on galvanized iron pipe shall be gun metal construction as per IS-778 class 2. Ends will be screwed to ANSI-B 2.1.

Note: However, valves in the flushing water lines shall be of type and material specified for the chemicals which is being flushed by the line.

4.14.06 Diaphragm Valves (for river water / clarified water / filtered water / similar application)

Metallic Unlined Diaphragm valves (manual / auto as specified elsewhere in this specification) may be used for isolation purposes.

The Metallic Unlined Diaphragm valves shall conform to the requirements addressed under Cl. No. 4.14.07 below except the requirements with reference to lining for body and integral flanges.

4.14.07 Diaphragm Valves (for decationized water / deanionized water / demineralized water / desalinated water / dilute and concentrated acidic solution / dilute and concentrated alkaline solution / similar application)

Metallic Diaphragm valves (manual / auto as specified elsewhere in this specification) may be used for isolation purposes.

The metallic diaphragm valves shall conform to the following requirements.

- a) Design Standard : BS EN-13397 or Equivalent (subject to approval by Purchaser) of required

- rating/class. (minimum rating of valves should be PN 10).
- b) Type : Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type.
- c) **Material of Construction**
- Body/Bonnet : Cast Iron IS-210 Grade FG.260 or Equivalent (subject to approval by Purchaser).
- Cast steel ASTM-A 216 Grade WCB.
- Body lining : Soft Natural rubber - 3 mm thick as per IS-4682 (hardness 85-90 on shore A), Ebonite polypropylene, PVDF.
- Diaphragm : Reinforced rubber, Hypalon
- Handwheel : Cast Iron
- Compressor : Stainless Steel
- Stem & Bush : Stainless Steel
- d) Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (min.) piping flanges, full face rubber lined and shall be cast / integral with the body.
- e) Handwheels shall be marked with the direction of closure.
- f) Valves shall be provided with a position indicator to show the open and closed condition.
- h) Valves provided with pneumatic actuators shall be provided with a handwheel for manual operation. The valves operators shall be designed as per applicable International Standard.
- i) The testing of valves will be as per BS EN-13397 and rubber lining will be tested as per IS-4682.

Note: For valves which may come in contact with concentrated acid/ alkali, the material of construction of diaphragm shall be as follows:

Diaphragm shall be of reinforced Teflon, EPDM for acid services and reinforced Neoprene / Hypalon for alkali services.

Use of Nonmetallic Diaphragm Valves for any specific / critical application shall be subject to approval by Purchaser and shall conform to the requirements of BS EN ISO 16138 - Industrial valves. Diaphragm valves of thermoplastics materials.

4.14.08 Plug Valves (for lime solution / sludge / similar application)

The plug valves shall conform to the following requirements.

a)	Design Standard	BS-5158 or Equivalent (subject to approval by Purchaser)
b)	Type	Flanged and non lubricated, regular pattern, plug valves.
c)	Material of Construction	
	Body	Cast Iron IS-210 Grade FG 260 or Equivalent (subject to approval by Purchaser)
	Plug	Stainless Steel AISI-316
	Body Sleeve or Seat	PTFE
	Seat	PTFE
	Gland	AISI-304 / AISI-316
	Cover	Cast Steel ASTM-A 216 Grade WCB
	Gland Nut	AISI-304 / AISI-316

- d) Valves shall be operated by permanently fitted wrench or Hand lever. Wrench shall be mounted so that they are parallel to the valve bore axis when the valve is in fully open condition.
- e) All valves shall be provided with an indicator for the position of the plug part.
- f) Suitable stops shall be provided for the fully open and fully closed positions of the valve.
- g) Valves of size of 250 mm NB and above shall be provided with a suitable reduction gear unit.
- h) Ends will be flanged and compatible with AISI-16.5 Cl. 150 (minimum) piping flanges.

4.14.09 Non Return or Check Valve (for river water / clarified water / filtered water / similar application)

Non return valves shall be of swing check (reflux) type or dual plate type.

The valves shall conform to the following specifications.

- i) Design Standard : IS-5312, BS-1868, BS-5153, API-594 / API-60 or equivalent (subject to approval by Purchaser)
- ii) Type : Swing check Type and Flanged ends.
- iii) Material of Construction:

a)	Body & Cover Hinge Disk/Door	Cast iron IS-210 Grade FG 260 / Cast Iron BS-1452 Grade 220 or equivalent (subject to approval by Purchaser)
b)	Hinge Pin and Door / Disc Pin	Cast steel ASTM-A 216 Grade WCB High tensile Brass IS-320 HT 2 or BS-2872 equivalent (subject to approval by Purchaser)
c)	Disc facing ring	Stainless steel
d)	Body Seat ring	Stainless steel
e)	Bearing bushes	Leaded Tin Bronze IS-318 Grade 2
f)	Bolts	Carbon Steel

Ends will be flanged and compatible with ANSI-B 16.5 Cl. 150 (minimum) piping flanges. .

Body shall be permanently marked with an "arrow" inscription indicating the direction of motion of the fluid for all the check valves.

For sizes 50 mm NB and below, check valves shall be gun metal body swing type as per IS-778. Ends will be screwed type to ANSI-B 2.1.

4.14.10

Non Return Valve (for decationized water / deanionized water / demineralized water / desalinated water / dilute and concentrated acidic solution / dilute and concentrated alkaline solution / similar application)

The valves shall conform to Cl. No. 4.09.00 above along with the following requirements:

- The body, cover & Disc shall be lined with natural Rubber, PTFE or Viton. The Hinge, Hinge Pin & Disc Pin shall be coated with PVDF, or suitable elastomer. The bearing bushes shall be PTFE or Equivalent (subject to approval by Purchaser) material (subject to approval by Purchaser). Bolting shall be of stainless steel. In the absence of lining/coating, the complete valve shall be of stainless steel construction (AISI-316).
- For only acid services Non- Return valves shall be of lined construction & Flap type.
- For alkali services, the complete valve shall be stainless steel construction (AISI-316) or of lined construction as specified above.

4.14.11

Valves for Sampling / Instrument Isolation Service

Each sampling valve / instrument isolation valve shall be full bore ball type.

Ball valves shall conform to the requirements stipulated under Cl.4.04.00 above. However, Body material shall be Stainless Steel (AISI-316).

4.14.12 Valves for Air Service

For Air services globe valves or Ball valves may be used for sizes 50 mm NB and below.

For sizes higher than 50 mm NB, either Butterfly valve or Ball valves shall be used.

Globe valves shall generally conform to Cl. 4.05. 00 above.

Ball valves shall conform to the requirements stipulated in Cl.4.04.00 above. However, Body material shall be leaded Tin Bronze (IS-318 Grade2) or stainless steel (AISI-304 / 316).

Butterfly valves shall conform to the Cl.4.03.05 to 4.03.09 of this section. However, the body & Disc shall be either cast iron lined with elastomer such as PVDF or PTFE or stainless steel construction (AISI-304 / 316).

4.14.13 Safety / Relief Valves

The safety valves / relief valves at the downstream of positive displacement type metering pumps shall be of the standard type manufactured by the pump manufacturer and the material of construction shall suit to the fluid handled.

4.14.14 Valves for Resin Transfer Line

In resin transfer line two way eccentric plug valve shall be used. The valves, shall have type 316 stainless steel body and bearings, resilient faced plug and flanged ends.

4.14.15 Isolation Gates

Design standard for gates shall be IS-3042 or Equivalent (subject to approval by Purchaser).

The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS-3042.

Material of Construction

i.	Frame and Door	Cast Iron IS-210 Grade 20
ii.	Spindles, bolts & nuts	M.S. to IS-2062
iii.	Face & seat rings	Gun metal (as per IS-3042).

All the parts of gates shall be applied with the coats of heavy duty bitumastic paint.

Each of the gates shall be provided with handwheel, and a position indicator.

The gates for DM plant drains shall be rubber lined to a minimum thickness of 4.5 mm.

4.15.00 Strainers
 4.15.01 Basket Strainers

- a) Basket strainers of simplex design shall have the following materials of construction for raw/clarified/filtered water application.

i.	Body	Fabricated mild steel : IS-2062 (Tested quality)
ii.	Strainers	Wire shall be stainless steel (AISI:316 18 BWG 30 mesh suitably reinforced. Reinforcement material shall also be of stainless steel construction.
iii.	Drain Plug / Nuts	Gun metal

- b) Inside and outside of basket body shall be protected with one coat of high build zinc phosphate primer and three coats of Chlorinated rubber paint to a total thickness of 200 microns.
- c) Suitable Vent and drain valves shall be provided for the strainers.
- d) Screen (strainer) flow area shall be at least four times pipe sectional area. Flow area in any portion of Basket strainer assembly shall not be less than the pipe cross sectional area.
- e) Pressure drop in clean condition shall not be more than 1.0 mwc at full flow.
- f) Basket Strainer shall be provided with lifting lugs and suitable mounting arrangement.
- g) For DM water service, body shall be rubber lined to minimum 4.5 mm thickness (soft rubber of shore Hardness $65 \pm 5^\circ\text{A}$).

4.15.02 Y-Type Strainer

- a) Y-Type strainer for water application shall be constructed of following materials:

i.	Body	Cast Iron IS-210 Grade FG 260
ii.	Strainers	Wires of stainless steel AISI-316, 18 BWG 30 mesh suitably reinforced. Reinforcement material shall also be of stainless steel construction.
iii.	Drain Plug / Nuts	Gun metal (threaded construction)

- b) Y-Type strainers shall also conform to Cl. 4.15.01 (b), (c), (d), (e) and (f).
- c) Body of the Y-type strainers of alkali, and demineralised water shall be of Cast Iron (IS-210 Grade FG 260) and lined with soft or hard rubber to a thickness of 3 mm.

- d) For acid services, apart from the rubber lined body material, the screen material, shall be Polypropylene or HDPE wire cloth of suitable mesh and thickness.

4.16.00 Resin Traps

The resin traps for the Ion exchange vessels shall be provided for the collection of Ion exchange resin shall conform to the following:

- 4.16.01 The body shall be of mild steel (IS-2062) and lined internally with rubber (Hard/Soft rubber), Saran or polypropylene. The internals (rod and screen) for all resin traps shall be of AISI-316 construction. All screen components shall be welded at each intersection of wire and support rod for good strength, Resin traps screen opening shall not exceed 120 percent of the associated process vessel under drain/backwash collection header nozzle screen opening and shall be suitably selected to retain even the minimum size of the resin selected for the process.

- 4.16.02 The resin traps shall be provided with a draining arrangement with a valve for collection of trapped resins. Resin trap body shall have lifting lug for easy handling during maintenance/erection.

4.17.00 General Requirements for Valves, Gates, Strainers and Resin traps

- 4.17.01 All the items shall be suitable for service conditions i.e. flow, temperature and pressure to which they may be subjected to.

- 4.17.02 All the items shall be of proven design for the duty conditions and the Bidder or manufacturer shall have sufficient experience in using the above equipment in water treatment application in the plants supplied earlier by them.

- 4.17.03 In case Purchaser desires, the experience list/feedback from the users shall be made available to Purchaser for any or all the equipments during the detailed engineering phase.

- 4.17.04 Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. Sample valves will be used in sample collection lines.

- 4.17.05 All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required. All the valves shall be of standard pressure rating of the applicable design code / standard. Non standard pressure rating shall not be accepted. The pressure and temperature rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed.

- 4.17.06 Valves pressure classes, sizes, types, body materials, and end preparation shall generally be as described herein, unless mentioned otherwise elsewhere in Bid Specification. All valves shall conform to the requirements of the governing codes, and the requirements specified.

- 4.17.07 Valves (including safety, relief and control valves) body materials shall be compatible with the piping with which they are used. If the body material is not of the same type as the material of the connecting pipe work, the valves shall be fitted with suitable welding nozzles to avoid dissimilar butt welds at site.

- 4.17.08 Each modulating control valve shall be provided with isolation valves. Manual bypass valve shall be provided for each modulating control valve to achieve safe and reliable manual operation.
- 4.17.09 All the actuators of the valves shall be designed to handle the maximum expected pressure differential across the valves and to overcome friction forces and unbalance forces due to the flow through valve.
- 4.17.10 Valve bodies and bonnets shall be designed to support the valve operators (handwheel, gear, or motor) with the valve in any position without external support.
- 4.17.11 Valve ends and size limitations are as follows:
- a) 50mm NB and smaller valves - Class 800 minimum with socket weld ends. (For instruments connections/ isolation valves screwed ends may be acceptable)
 - b) 65mm NB and larger size valves - Class 150 minimum (butt-weld ends or flanged or wafer style).
 - c) Flanged steel butterfly valves - 750mm and larger size; pressure class per AWWA / BS-5155.
- 4.17.12 Gate, globe and angle valves shall be outside stem and yoke construction.
- 4.17.13 Valves sizes 65 mm NB and larger shall have a non-rising handwheel.
- 4.17.14 All the actuator operated valves shall be fitted with handwheel for manual operation. The pneumatic actuators shall be selected based on the available air pressure and operating air pressure (maximum and minimum). The supporting calculations for selection of actuators shall be furnished for Purchaser's approval before finalization of all the actuators.
- 4.17.15 Valves coming under the purview of IBR if any shall meet its requirements and the approval of the same shall be obtained by the Bidder.
- 4.17.16 Sizes of the valves shall be same as that of the interconnected pipe sizes except for the control valves.
- 4.17.17 The various items shall be installed such so that they are easily approachable for the operating and maintenance personnel. All valves shall be accessible without chain pulls, as far as possible. Generally Valves shall be located about 1.2 meter to 1.5 meter from the operating platform and also they shall not be located below the ground level such as beneath the trenches etc. In such cases, extended spindle shall be provided with chain operating from operating floor. Valves which are installed below the ground floor shall be provided with a floor mounted pedestal at the top of the operating floor. Valves which are installed below the ground floor shall be provided with a floor mounted pedestal at the top of the operating floor. The position indicator for such valves shall be also provided along with the stand.
- 4.17.18 All valves shall be provided with hand wheels. Wherever necessary, chain operator shall be provided so that the valve may be operated from the ground floor.
- 4.17.19 All valves shall be provided with cast heat marks on casting of Body and Bonnet.

- 4.17.20 Whenever screwed valves will be installed in a pipe line, it will always be followed by screwed three piece union of same material as that of pipe.
- 4.17.21 Short pieces used for welding of different pipe fittings and valves shall not be less than 80 mm in length.
- 4.17.22 However valves which are provided (in the buried pipe line) with a valves chamber shall have manual operator/Handwheel inside the valve chamber. The valve chamber shall be provided with built in ladders/staircases and sufficient operating space within the chamber shall also be provided for easy operation of such valves.
- 4.17.23 All the valves, strainers, resin traps etc. shall be provided with external painting as that of the interconnected piping as specified in Clause 3.03.14 above. However, surfaces such as Stainless Steel, aluminium, copper, brass, bronze and other non-ferrous materials shall not be painted. No paint or filter shall be applied until all repairs, hydrostatic tests and final shop inspections are completed, but shall be applied prior to shipment.
- 4.18.00 Rubber Expansion Joint
- 4.18.01 The inner cover (i.e. the tube) and also the outer cover shall be made up of natural or synthetic rubber of adequate thickness. The carcass between the tube and the cover shall be made up of high quality cotton and rayon cord having suitable number of plies and impregnated with rubber or synthetic compounds. Moreover, to ensure adequate strength, reinforcements consisting of metal rings embedded in the carcass, shall be provided.
- 4.18.02 In all cases, the expansion joints shall be integral flanges at both ends complete with split retaining rings.
- 4.18.03 Each of the expansion joint shall be provided with adequate number of limit rod assemblies which shall be tightened after erection of the entire suction branch of the pumps, in order to avoid transmittal of undue pressure thrust on to the pump foundation. Each of these limit rod assemblies shall consist of a long bolt and two connecting plates which are, in turn securely bolted to opposite flanges. Each plate is to be drilled with three holes, two for bolting to the flange, the third for passage of the stretcher belt. Rubber washers backed with metal washer shall be placed under the head of the bolt and under the nut.
- 4.19.00 Protective Lining and Painting
- The supply and application of Protective Lining and Painting with reference to Piping, Fittings and Valves need to be as per **Sub Section: Section-XIII of V.III-C– Technical Specification for Protective Lining and Painting**, attached herewith.
- 5.00.00 **TESTS AND INSPECTION**
- 5.01.00 Tests & Inspection for Pipes and Fittings
- 5.01.01 Shop Tests
- Shop test shall include all tests to be carried out at supplier's work, works of sub

suppliers and at works where raw materials supplied for manufacture of equipment are produced. The supplier shall carryout a comprehensive inspection and testing program during manufacture at works. Necessary Manufacturing and Field Quality Plans shall be prepared by supplier and submitted for approval by Purchaser for all checks conducted on raw materials, fabrication etc.

Calibrated instruments required for measuring / testing of pipes shall be arranged by manufacturer at their works during inspection.

Purchaser shall be given full access to all tests. The manufacturer shall inform Purchaser of the testing well in advance so that Purchaser at own option may witness the test.

All the test certificates and reports shall be submitted to Purchaser for approval.

All the mechanical and chemical tests including optional tests if any as per the applicable codes / standards shall be carried out and the test certificates for the same shall be submitted for approval by Purchaser. Material Certificate shall be furnished for each grade / lot of pipes. All material test certificates shall carry material specification, size, class, length, chemical composition, physical properties and heat number or other acceptable reference to enable correlation of the certificate with the pipe. IBR / CCE / TAC approval certificates / any other statutory approval certificates as required shall be furnished.

Welding procedure and welder performance qualifications shall be carried out. Mechanical and chemical tests shall be carried out as per code. Spot radiography check shall be carried out for all butt welds. D.P.T shall be carried out for all root run welds. Segmented flanges exceeding 30 mm thickness shall be stress relieved. Tensile test, eddy current test, bend test, flattening test and dimensional checks as per applicable code shall be carried out.

All rubber lining is to be subjected to the following tests as per IS-4682 Part I:

- a) Adhesion test.
- b) Tests to check resistance to bleeding.
- c) Measurement of thickness of lining.
- d) Shore hardness test.
- e) Spark test at High voltage 5 KV / mm of thickness.

Galvanizing shall be carried out as per IS-4736 / IS-2629 and tested as per IS-2633 / BS- 729. The test shall include weight of coating, uniformity of thickness and adhesion test.

All pipes and fittings shall be subjected to hydraulic tests as per applicable code / standard. When rubber lined, hydraulic tests shall be carried out before and after rubber lining.

Buried pipes where wrapping and coating is done, material for wrapping and coating shall be tested as per applicable code. Procedure for wrapping and coating and its testing shall be submitted for approval by Purchaser. Entire wrapping and coating shall be checked for thickness and Holiday test. Peel test shall be done to ensure

proper bonding of coating to surface.

5.01.02 Site Test

Hydraulic tests of the piping system at 1.5 times the design pressure or twice the working pressure whichever is higher shall be carried out for a period of minimum 30 minutes. However, if the Code / standard of supplied piping specifies more stringer requirements than the above criteria, then the hydraulic tests shall be conducted as per the applicable piping code / standard.

Pneumatic tests shall be carried out for all pressure piping that shall not be subjected to water filling.

The Bidder shall make all temporary closures/connections as required for hydro-static/pneumatic testing and clean/remove the same after successful completion of the test.

The procedure for hydro test and pneumatic test shall be submitted by the Bidder for review and approval by Purchaser.

All tests as indicated in FQP approved by Purchaser shall also be carried out.

5.02.00 Tests & Inspection for Valves / Gates / Strainers

5.02.01 Shop Tests

Chemical composition of all material, castings, forgings, etc. shall be tested for various components of the valves, gates, strainers and test certificates shall be submitted for approval by Purchaser.

Mechanical tests including optional tests if any shall be performed as per the applicable code / standard and the test certificates for the same shall be submitted for approval by Purchaser. The performance requirements of the valves shall also be tested as per the applicable code / standard.

Elastomer wherever coated or lined for the valves shall be tested for the corrosion resistance against the medium for which those are selected as per applicable code / standard and the test certificates shall be furnished for approval by Purchaser.

Rubber lining on Valves / Gates / Strainers / Resin Traps shall be checked in accordance with IS-4682 Part I including Spark Testing at high voltage (5 KV/mm of thickness).

All the valves shall be hydraulically tested for the body, seat, back seat and all valves shall be pneumatically tested for seat as per the applicable code / standard to which these are designed irrespective of the working pressure for which valves are selected.

Wherever specifically required, pressure drop across each type and each size of the valve at various flows shall be conducted, and test reports shall be submitted for approval by Purchaser. Type test report for this test (if already carried out by the manufacturer) may be submitted to fulfill this requirement.

Gates shall be tested against leakage and strength as required in the code / standard.

Strainer shall be hydraulically tested its strength and the pressure drop across the strainer assembly shall be verified at design flow for clean condition.

5.02.02 Site Tests

All valves, gates, resin traps, strainers and other fittings after erection at site shall be tested to hydraulic test pressure of two times the operating pressure or 1.5 times the maximum allowable pressure whichever is higher for a period of 120 minutes.

All valves / gates (Manual / Automatic) shall be operated throughout 100% of the travel manually and as well as from control panel and these should function without any trouble whatsoever.

VOLUME : III-C

SECTION-IX

**GENERAL TECHNICAL REQUIREMENT
FOR
HORIZONTAL CENTRIFUGAL PUMPS**

SECTION: IX
TECHNICAL SPECIFICATION
FOR
HORIZONTAL CENTRIFUGAL PUMPS

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES AND STANDARDS	1
3.00.00	DESIGN AND CONSTRUCTION	1
4.00.00	TESTING	4

SECTION : IX

TECHNICAL SPECIFICATION
FOR
HORIZONTAL CENTRIFUGAL PUMPS

1.00.00 INTENT OF SPECIFICATION

The specification covers the design, performance, manufacturing, shop testing, erection, testing and commissioning at site, of the horizontal centrifugal pumps.

2.00.00 CODES AND STANDARDS

2.01.00 The design, manufacture and performance of the horizontal centrifugal pumps shall conform to the latest revisions of the following codes and Indian standards, in addition to other stipulations and standards mentioned elsewhere in the specification :

- a) IS-1520 : Horizontal centrifugal pumps for clear cold fresh water.
- b) IS-5120 : Technical requirement rotodynamic special purpose pumps.
- c) IS-5639 : Pumps handling chemicals and corrosive liquids.
- d) IS-5659 : Pumps for process water.
- e) Standards of Hydraulic Institute, U.S.A.

2.02.00 The material of construction for the various components of the pumps shall conform to the applicable standards like "American Society of Testing & Materials (ASTM)" and Indian Standards.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 Pumps shall be of horizontal/vertical split casing with speed preferably be limited to 1500 RPM. Design and construction of various components of the pumps shall conform to the following general specifications. For material of construction of the components, data sheets in Appendix-I of SECTION-III may be referred to.

3.01.01 Casing

The casing shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimize radial loads at part load operations.

3.01.02 Impeller

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

The impeller shall be as per the proven design of the manufacturer. It shall be keyed to the shaft and locked in position. The rotor assembly shall be statically and dynamically balanced and designed with critical speed substantially above the operating speed.

3.01.03 Impeller/Casing Wearing Rings

Replaceable type wearing rings shall be provided at suitable locations for each pump. The rings shall be so fitted as to prevent turning while the pump is in operation.

3.01.04 Shaft

The shaft shall be adequately sized to withstand all stress from rotor weight and hydraulic loads etc. The shaft shall be ground and polished to final dimensions.

3.01.05 Shaft Sleeves

Pump shafts shall be protected by renewable type shaft sleeves which shall extend well beyond the pump glands. The sleeves shall be highly polished and shall be securely fastened to the shaft to prevent any loosening.

3.01.06 Bearings

Heavy duty bearings, adequately designed for the type of service specified and for long and trouble-free operations, shall be furnished. The design shall be such that the bearing lubricating oil does not contaminate the liquid being pumped.

3.01.07 Thrust Bearings

Adequately designed thrust bearings to absorb pump thrust or other unbalanced force, if any, shall be provided.

3.01.08 Lubrication system shall be designed in such a way that in case of total power failure, there will not be any damage while coasting down to stop.

3.01.09 Stuffing Boxes

Stuffing boxes of packed ring construction or of mechanical seal type as desired in the Data Sheet - Appendix-II attached with this specification shall be provided. The necessary piping, valves, fitting etc. for the gland sealing connection shall be provided. For mechanical seals, the mating surfaces shall be suitably hard faced to ensure long life.

3.01.10 Pump Shaft-Motor Shaft Coupling

The pump shaft and motor shaft shall be connected with a suitably designed flexible coupling of approved design preferably with a spacer to facilitate dismantling of the

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

pump without disturbing the motor. Necessary coupling guards for the coupling shall also be furnished.

3.01.11 Base Plate

A common base plate for mounting the pump and the corresponding driver motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, properly ribbed as required. Driplip with drain tap suitable for type of service specified shall be furnished.

3.01.12 Drain, Vent and Priming Connections

Each pump shall be provided with a casing drain, vent and priming connection at suitable locations.

3.01.13 Drive Motor and Its Control

Please refer Electrical Specification enclosed herewith this specification.

3.01.14 Anchor Bolts, Sleeves, Inserts, Lifting Lugs, Eye Bolt, etc.

All anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for the equipment are to be supplied. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level.

Each equipment shall be provided with suitable lifting lugs, eye bolts etc. to facilitate maintenance.

3.02.00 Consistent with good operating characteristics and high efficiency, each pump shall have a continuously rising head capacity characteristics curve without any zone of instability. Power flow characteristic shall preferably be non-overloading type beyond rated duty point. The characteristic curves of each set of pumps shall match each other for equal sharing in case of parallel operation. The pump motor set shall be designed in such a way that there is no damage due to reverse flow through the pump which may occur due to any mal-operation of the system.

3.03.00 The pumps shall be suitably designed also for smooth and trouble free continuous solo operation in the event of trip out of the remaining pumps running in parallel.

3.04.00 The pumps shall be designed to have best efficiency at the rated duty point. The pumps shall be suitable for continuous operation within a wide range above and below the rated duty point. Such range of operation within which category of pumps can satisfactorily operate on continuous basis, shall be clearly indicated.

3.05.00 Drive motors for each category of pumps shall be suitable for use on 415V $\pm 10\%$, 30 , 50 Hz $\pm 5\%$ and neutral grounded system. Drive motors shall have 15% spare margin over the maximum power requirement of the pump within the range of operation.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

4.00.00 TESTING

4.01.00 **Testing and Inspection at Manufacturer's Works**

4.01.01 All tests required shall be conducted to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with requirements of the applicable codes.

The particulars of the proposed tests and the procedures for the tests shall be submitted for approval before conducting the tests.

4.01.02 The representatives of Purchaser shall be given full access to all tests. Prior to pump performance tests, the manufacturer shall inform the Purchaser allowing adequate time so that if the Purchaser desires, his representatives can witness the test.

4.01.03 All materials and casting used for the equipment shall be of tested quality. The test certificates shall be made available to Purchaser.

4.01.04 The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut-off head, whichever is higher. The test pressure shall be maintained for at least half an hour.

4.01.05 The pump rotating parts shall be subjected to static and dynamic balancing tests.

4.01.06 All pumps shall be tested at the shop for capacity, head efficiency and brake horse power and cavitation. The tests are to be done according to the requirement of the "Hydraulic Institute" of USA, ASME Power Test Code PTC-8.2 (latest edition) and Indian Standards as applicable.

4.01.07 The pump accessories e.g. the thrust bearing, the motor pump shaft coupling etc. will be subjected to tests as per Manufacturer's standard.

4.01.08 The combined vibration of pump and motor should be restricted to the limits specified by Hydraulic Institute Standards, USA, when the pump is in operation at any load singly or in parallel.

4.01.09 Tests on motors shall be conducted as per electrical specification enclosed herewith this specification.

4.01.10 The reports and certificates of all the above mentioned tests to ensure satisfactory operation of the system shall be submitted to the Purchaser before despatch.

4.01.11 Cast heat marks are to be provided on castings for casing and impeller.

4.02.00 Tests at Site

After erection at site, pumps under different services shall be operated to prove satisfactory performance as individual equipment as well as a system.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

VOLUME : III-C

SECTION-X

**GENERAL TECHNICAL REQUIREMENT
FOR
VERTICAL CENTRIFUGAL PUMPS**

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15 -V-III-C-Sec-X.doc)

V.III-C/S-X: 1

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

SECTION : X

TECHNICAL SPECIFICATION
FOR
VERTICAL CENTRIFUGAL PUMPS

C O N T E N T S

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES AND STANDARDS	1
3.00.00	DESIGN AND CONSTRUCTION	1
4.00.00	TESTING	4

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15 -V-III-C-Sec-X.doc)

V.III-C/S-X: 2

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

SECTION: X

TECHNICAL SPECIFICATION FOR VERTICAL CENTRIFUGAL PUMPS

1.00.00 INTENT OF SPECIFICATION

The specification covers the design, performance, manufacturing, shop testing, erection, testing and commissioning at site, of the vertical centrifugal pumps.

2.00.00 CODES AND STANDARDS

2.01.00 The design, manufacture and performance of the vertical centrifugal pumps shall conform to the latest revisions of the following codes and Indian Standards in addition to other stipulations and standards mentioned elsewhere in the specification :

- a) IS-1710 : Vertical turbine pumps for clear, cold, fresh water.
- b) IS-5120 : Technical requirement for rotodynamic special purpose pumps.
- c) IS-5639 : Pumps handling chemicals and corrosive liquids.
- d) IS-5659 : Pumps for process water.
- e) Standards of Hydraulic Institute, USA.

2.02.00 The material of construction for the various components of the pumps shall conform to the applicable standards like "American Society of Testing & Materials (ASTM)" and Indian Standards.

3.00.00 DESIGN AND CONSTRUCTION

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15 -V-IIIC-Sec-X.doc)

V.III-C/S-X: 1

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

3.01.00 Pump Type

The pumps shall be vertical wet pit type with open shaft or enclosed shaft construction depending on the type of liquid to be pumped. Material of construction shall be as per the data sheets in Appendix-II. The pump shed shall preferably be limited to 1500 RPM.

3.02.00 Discharge Head Assembly

The pump shall have fabricated discharge head disposed above the ground. The head shall be capable of supporting the pump and motor on the foundation; expansion joint shall be provided immediately at the pump discharge; but no thrust block shall be provided for the unbalanced hydraulic thrust thus developed. The anchor bolts and pump fixing arrangement shall be suitably designed to take up the back thrust due to the expansion joint.

The head shall contain a packed type stuffing box to prevent any leakage.

A water stinger may be fitted to the top shaft to protect the motor from water spray.

3.03.00 Bowl

In addition to housing the impellers properly, the bowls shall provide a smooth path to water passage and shall be hydraulically designed to minimise radial thrust.

3.04.00 Impeller

The impeller shall be closed or open as per standard design of the manufacturer. All rotating parts including the impeller shall be statically and dynamically balanced. The critical speed of all the rotating parts shall be substantially above the design speed.

3.05.00 Pump Shaft and Motor Shaft Coupling

The pump shaft shall be connected to motor shaft by a heavy duty flexible coupling.

3.06.00 Column Pipe and Shaft

DEVELOPMENT CONSULTANTS

(e-PCT-TS-K-02-2014-15 -V-IIIC-Sec-X.doc)

V.III-C/S-X: 2

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

The line shaft and the shaft enclosing tube shall be made in convenient sections and shall be joined securely by union couplings. The column pipe shall also be made in sections and shall be joined by flanged coupling. In case of flanged joint gaskets shall be provided at each connection.

For sludge handling, vertical cantilever pump with no submerged bearing shall be provided.

3.07.00 Shaft Sleeves

Replaceable shaft sleeves shall be furnished. The shaft sleeve shall be securely locked to shaft to prevent loosening while in operation.

3.08.00 The necessary supporting frame, base-plates, sole-plates, mounting-plates, etc. as required shall be supplied under this specification, alongwith anchor bolts, foundation bolts, pipe sleeves etc.

3.09.00 Thrust Bearings

Thrust bearing of adequate design shall be furnished for taking the pump weight as well as maximum hydraulic thrust. The bearing may be lubricated by grease or oil. The design should be such that the bearing lubricating oil does not contaminate the liquid being pumped. Cooling of thrust bearing, if necessary, shall be done by liquid tapped from the discharge of the pump itself. The thrust bearing shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point.

3.10.00 Line Shaft and Bowl Bearing

Adequate number of properly designed bearings shall be furnished to prevent undue vibration.

3.11.00 Lubrication system shall be designed in such a way that in case of total power failure, there will not be any damage while coasting down to stop.

3.12.00 Shaft Enclosing Tube

For sludge/turbid/dirty water/chemical services, the pump shaft shall be of enclosed tube construction. For the lubrication of shaft necessary clarified/filtered water required shall be arranged. Necessary piping, valves, fittings, booster pumps etc. as required shall be included in scope.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 3.13.00 **Suction Bell**
- The pump shall be complete with adequately dimensioned suction bell to guide and streamline intake fluid.
- 3.14.00 **Adjustment of Impeller**
- The pump shaft shall have suitable arrangement for vertical adjustment of impeller position from an accessible point.
- 3.15.00 **Pump Characteristics**
- Head capacity curve should be rising upto the shut-off head condition. Power versus capacity curve shall be non-overloading type beyond rated duty point.
- The characteristic curves of each set of pumps shall match each other for equal load sharing in case of parallel operation. The pump shall however, be also designed for smooth and trouble-free continuous solo operation in the event of trip-out of the remaining pumps running in parallel.
- 3.16.00 The pumps shall be designed for reverse flow through them. The drive motor shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed when power to the drive is restored.
- 3.17.00 The pumps shall be designed to have best efficiency at the rated duty point.
- The pumps shall be suitable for continuous operation within a wide range above and below the rated duty point. Such range of operation within which the pumps can satisfactorily operate on continuous basis, shall be clearly indicated.
- 3.18.00 Drive motors for the pumps shall be suitable for use on 415V $\pm$ 10%, 3 ϕ , 50 Hz, $\pm$ 5% and neutral grounded system. Drive motors shall have 15% spare margin over the maximum power requirement of the pump within its range of operation.
- 4.00.00 **TESTING**
- 4.01.00 **Testing and Inspection at Manufacturer's works**

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 4.01.01 All tests required shall be conducted 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 Purchaser for approval before conducting the tests.
- 4.01.02 The representatives of Purchaser shall be given full access to all tests. Prior to pump performance tests, the manufacturer shall inform the Purchaser allowing adequate time so that if the Purchaser so desires, his representative can witness the test.
- 4.01.03 All materials and casting used for the equipment shall be of tested quality. The test certificates shall be made available to the Purchaser.
- 4.01.04 The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut-off head, whichever is higher. The test pressure shall be maintained for at least half an hour.
- 4.01.05 The pump rotating parts shall be subjected to static and dynamic balancing.
- 4.01.06 All pumps shall be tested at the shop for capacity, head, efficiency, brake horse power and cavitation. The tests are to be done according to the requirements of the Hydraulic Institute of USA, ASME Power Test Code, Indian Standards, as applicable.
- 4.01.07 The pump accessories e.g. the thrust bearing, the motor pump shaft coupling etc. will be subjected to tests as per manufacturer's standards.
- 4.01.08 The combined vibration of pump and motor should be restricted within limits specified by Hydraulic Institute Standards, USA when the pump is in operation at any load singly or in parallel.
- 4.01.09 Tests on motors shall be conducted as per electrical specification enclosed with this specification.
- 4.01.10 Test reports and certificates of the above mentioned tests to ensure satisfactory operation of the system shall be submitted to the Purchaser before despatch.
- 4.01.11 Cast heat marks shall be provided on castings for casing and impeller.
- 4.02.00 Test at Site

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

After erection at site, pumps under different services shall be operated to prove satisfactory performance as individual equipment as well as a system.

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15 -V-IIIC-Sec-X.doc)

V.III-C/S-X: 6

VOLUME : III-C

SECTION-XI

**GENERAL TECHNICAL REQUIREMENT
FOR
POSITIVE DISPLACEMENT PUMPS**

SECTION : XI
TECHNICAL SPECIFICATION
FOR
POSITIVE DISPLACEMENT PUMPS

CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	GENERAL DESIGN FEATURES	1
3.00.00	TESTING	2

SECTION: XI

TECHNICAL SPECIFICATION FOR POSITIVE DISPLACEMENT PUMPS

1.00.00 INTENT OF SPECIFICATION

This specification covers the design, performance, manufacturing, shop testing, erection, testing & commissioning at site, of the positive displacement pumps.

2.00.00 GENERAL DESIGN FEATURES

This specification provides guideline for design, manufacturing and testing of positive displacement pumps with variable capacity to inject chemicals, generally used in the treatment of water in metered amounts.

2.01.00 Pumps shall be simplex/duplex type, positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit.

2.02.00 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 automatically, wherever required, by pneumatic stroke positioner in proportion to a 0.2 - 1.0 Kg/Sq.Cm air signal or manually. For automatic pumps, in addition to the automatic control, manual control facility shall also be provided. Manual control facility shall be of micrometric adjusting type.

2.03.00 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.

2.04.00 Pumps shall be provided with an integral relief valve, spring operated, to release pressure when delivery line blockage occurs.

2.05.00 Crank case shall be constructed of high quality cast iron, which will also house the gear box and guides for cross head.

2.06.00 Material of construction should be as follows :

◆ Crank case	Cast iron.
◆ Pump head	Polypropylene.
◆ Valve and valve housing	Polypropylene.
◆ Wheel	Cast iron to a 48.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

♦ Worm	AISI 4142.
♦ Shafts (worm)	En 19.
♦ Diaphragm	Chemically inert teflon.
♦ Base plate	MS.
♦ Foundation bolts	MS.

- 2.07.00 Suitable gland seal should be provided to prevent leakage.
- 2.08.00 Electric drive motor particulars should follow Electrical Specification, enclosed herewith.
- 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 Purchaser for approval before conducting the tests.
- 3.01.02 The representatives of Purchaser shall be given full access to all tests prior to pump performance tests. The Manufacturer shall inform the Purchaser allowing adequate time so that if the Purchaser 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 Purchaser.
- 3.01.04 The pump casing shall be hydraulically tested at 200% of pump operating pressure or 15 Kg/Sq.Cm(g) whichever is higher. The test pressure shall be maintained for at least half an hour.
- 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, repeatability accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. ASME Power Test Code and Indian Standards or as per API.- 675.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per Manufacturer's standards.
- 3.01.08 The combined vibration of pump and motor should be restricted within limits specified by Hydraulic Institute Standards, USA, when the pump is in operation singly or in parallel.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 3.01.09 Test reports and certificates of all the above mentioned tests to ensure satisfactory operation of the system shall be submitted to the Purchaser before despatch.
- 3.01.10 Performance test shall be carried out for the setting of pressure relief valve.
- 3.02.00 Test at Site
- After erection at site, pumps under different services shall be operated to prove satisfactory performance as individual equipment as well as a system.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME : IIIF

SECTION-I GENERAL TECHNICAL REQUIREMENT FOR SUMP PUMPS, DRIVES AND ACCESSORIES

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES & STANDARDS
3.00.00	GENERAL PERFORMANCE REQUIREMENT
4.00.00	SCOPE OF WORK
5.00.00	DESIGN AND CONSTRUCTION
6.00.00	INSPECTION AND TESTING
7.00.00	DRAWINGS, DATA, INFORMATION REQUIRED

ATTACHMENTS

ANNXURE-I	DATA SPECIFICATION SHEET
ANNXURE-II	SCHEDULE OF SUMP PUMPS

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

VOLUME : IIIF

SECTION-I

SUMP PUMPS, DRIVES AND ACCESSORIES

1.00.00 GENERAL INFORMATION

1.01.00 Sump pumps specified hereinafter shall be used to dewater various sump pits in the power house and other plant area where gravity draining will not be envisaged and to ensure general housekeeping. Sump pumps of coal handling plant and ash handling plant are being covered under specification of respective packages.

1.02.00 Sump Pumps under this specification have been divided into following four (4) groups according to different duty envisaged and location of sumps/pits. Also Sewage Transfer Pumps are considered separately which will be located in the sewage lifting stations.

1.02.01 Group - A

The Group - A pumps shall be electric motor driven permanently installed vertical wet pit bottom suction volute type and will handle drainage water, containing solid particles with sludges, polluted liquid etc. from the area where they are installed. These pumps will run continuously by the use of high and low level switches in the sump. Particle size in the water will not exceed 15 mm. These pumps should be installed in the sumps/pits at the following locations:

- a) Power house ground floor sump pit near condenser.
- b) Underground Conveyor tunnel in the Mill Reject System
- c) Drain oil pit in transformer yard.

The pumps under serial no. (c) above should be capable to handle significant amount of transformer / fuel oil also.

Group-A pumps shall also be provided to all indoor sumps of the plant and outdoor sumps of capacity 5 cu.m and above and underground cable vaults except Ash Handling Plant.

1.02.02 Group - B

These pumps shall be horizontal centrifugal electric motor driven portable type. Each pump set along with control panel etc. shall be mounted on a trolley for ease of transportation. These pumps shall be suitable for handling drainage water containing hard solid particles, sludge, polluted liquid, significant amount of fuel oil etc. and particle size will not exceed 20 mm. These types of pumps shall be used in different plant areas e.g. fuel oil pressurizing pump house.

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-1)

V.IIIF/S-I : 1

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15
1.02.03 Group - C

The Group - C pumps shall be vertical submersible portable type pump motor sets with suitable arrangement for carrying to any place and for lowering to and raising from various water reservoirs and pits. The pump motor set shall be suitable for handling water containing muds/sludge, solid particles, cotton waste, silica, ash particles, coal particles, polluted liquid etc. The particle size in water will not exceed 20 mm. These pumps will be utilised to dewater various deep sumps/pits (e.g. C.W pump house, Plant Service water pump house etc.) in case of any eventuality.

1.02.04 Group - D

These pumps shall be similar to Group - A pumps except that these pumps will be used to handle water containing solid particles, sludges, ash polluted liquids, etc. Particle size in the water will not exceed 25 mm. These pumps should be installed in the sumps/pits at the Ash Handling Plant Buildings.

These pumps shall also be provided to all other indoor sumps and outdoor sumps of capacity 5 cu.m and above.

1.02.05 Sewage Transfer Pumps shall be located in the sewage lifting stations which will transfer sewage from sewage lifting station to sludge collection pit. These pumps shall be vertical submersible type. The capacity, head and no. of pumps shall be finalized by the bidder.

NOTE: Total numbers and rating of all the groups of sump pumps are given in Annexure- II and Annexure-III enclosed with this specification. However, the number of permanently installed sump pumps shall be 15 (minimum) for usage and portable sump pumps shall be 10 (minimum) conforming to the standards.

2.00.00 CODES AND STANDARDS
2.01.00 The design, manufacture and performance of the sump pumps and drives specified, hereinafter, shall comply with the requirements of all applicable codes, the latest applicable Indian/British/American/DIN Standards, in particular the following:

2.01.01 IS-1710 : Vertical Turbine Pumps for clear cold and fresh water.

2.01.02 IS-5120 : Technical Requirements - Rotodynamic special purpose pumps.

2.01.03 IS-5600 : Sewage and drainage pumps.

2.01.04 Hydraulic Institute Standards of USA.

2.02.00 The materials of the various components shall conform to the applicable IS/BS/ASTM/DIN Standards.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

3.00.00 GENERAL PERFORMANCE REQUIREMENT

- 3.01.00 The pumps shall be designed to have best efficiency at the specified duty point. The pump set shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated by the manufacturer.
- 3.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum head being at shut off.
- 3.03.00 Permanently installed vertical pumps shall be suitable for parallel operation. The head vs capacity, the BHP vs capacity characteristics etc. shall match to ensure equal load sharing and trouble free operation throughout the range. Drive Motor shall not be overloaded when pump discharge is more than rated condition.
- 3.04.00 The static head requirement of portable submersible type sump pump may have a considerably wide range of variation depending upon the depth of pit being dewatered. While the pump shall have adequate capacity at the maximum head, the motor shall be sufficiently rated to cater for any overloading during the pump operation at its minimum possible head, i.e., maximum discharge.
- 3.05.00 Pump motor set shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall generally be guided by Hydraulic Institute Standards (latest edition).

4.00.00 SCOPE OF WORK

- 4.01.00 Pumps under groups A, B, C, and D as listed in the - II along with drive motors, couplings and other accessories mentioned below, as also those needed to make the pump-motor sets complete in all respect, for proper operation and maintenance. All motors in outdoor duty will be provided with IP-55 enclosure. The accessories shall include among other things of the following :

4.02.00 For the Vertical Group - A Sump Pump Motor Sets

- a) Discharge of sump pump under sl. no. 'a', 'b' & 'c' shall be led to the nearest surface drain, Common Effluent Treatment Drain (CETD) & oil water separator respectively. This shall include a non-return valve and an isolating valve for each pump, necessary pipes, fittings, flange connections and counter flange with bolts, nuts and gaskets.
- b) A common baseframe for the purpose of supporting the pump motor sets in each sump, utilising embedded curb angle around the top of the sump. The base frame shall also be used to support each discharge piping.
- c) Three (3) nos. electrode type capacitance level switches per sump; one for low level, the second for high level and the third for very high

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

level, along with necessary junction box, local control panel, control cables etc. to achieve automatic startings/stopping of the sump pumps, and also ON/OFF indication for sump pump shall be monitored at DCS. The entire assembly being mounted on the same base frame as mentioned above (item "b"). The control panel shall also be equipped with start/stop push button for starting/stopping individual sump pumps manually. Local control panel and cable shall be as per Volume-V of the specification.

4.03.00 For each of the Trolley Mounted Horizontal Group-B Sump Pump Motor Sets

- a) One (1) no. 7.5 meters long hose for the pump suction and one (1) no. 30 meters long hose for the pump discharge, either ends of each hose being provided with female hose coupling.
- b) One (1) no. 500 mm long straight pipe piece, with both ends flanged, one end matching with the pump suction nozzle.
- c) Two (2) nos. male type hose couplings, one of which is suitable for coupling with the above mentioned 500 mm pipe piece on one side and the 7.5 meters long suction hose on the other side, whereas the other is suitable for coupling with the pump discharge nozzle on one side and the 30 metres long hose on the other side. The pump suction pipe-piece and discharge nozzle shall be of flanged type. As such each coupling end that is to match with the pipe/pump nozzle shall also be flanged and shall be equipped with necessary bolts, nuts & gaskets.
- d) A foot valve (of Bidder's recommended size) with suction strainer, necessary coupling and matching piece/reducer (if necessary) to couple with the 7.5 meter long suction hose end.
- e) A starter panel complete with incoming switch/contact, fuse, overload relays, start-stop push button, O/L reset push button, cable gland, wiring terminals, red and green indication lamps (LED type), necessary control cables etc., and also 50 metres length of flexible power cable with power plug at one end and arrangement to connect the other end with the starter panel.
- f) The pump motor set with a baseframe along with the starter panel, power cable, suction & discharge hoses etc., as mentioned above, shall be mounted on a suitable trolley with swivelling front wheel and having adequate fixing arrangement for all equipment, for operation without any undue vibration and with facility for being handled by a single operator.

4.04.00 For each of the portable submersible Group-C sump pump motor sets.

- a) Two (2) nos. 30 metres long discharge hose, having female hose coupling at both ends.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- b) One (1) no. 500 mm long pipe piece with both ends flanged, one end connected by necessary bolts, nuts & gaskets with the flanged discharge nozzle of the sump pump.
 - c) One (1) no. male type hose coupling, one end of which is suitable to couple with the discharge hose and the other end is flanged, matching with the above mentioned 500 mm long pipe end and connected therewith by necessary bolts, nuts & gaskets.
 - d) Suitable attachment for temporary seat of the pump motor set on the floor at sump bottom.
 - e) One (1) no. 25 metres long submersible type power cable having a power plug at one end and a hermetically sealed (water proof) cable gland for connection with the pump drive- motor at the other end.
 - f) Suitable lugs and other attachments on the pump motor assembly frame, for hoisting and lowering of the pump motor set from and to the sump.
 - g) One starter panel, having a plug socket as receptacle of the above mentioned power plug (item "e"), a 25 metre long incoming power cable with switch/contacter and fuse, start- stop push buttons, red and green LED type indication lamps, over load relays, O/L reset push button, cable gland etc., and also a suitable arrangement for temporarily mounting the starter panel, near the sump, where the portable sump pump-motor set is to work. The incoming 25 metre long power cable shall also be provided with a suitable power plug at one end.
- 4.05.00 For the vertical Group - D sump pump motor sets, the scope of supply should be similar to Group - A sump pump motor sets, except that the discharge piping from pump nozzles should be taken upto the following areas:
- a) For ESP Control Building, the sump pump discharge shall be taken to Ash Slurry Sump.
- 4.06.00 Vertical submersible pump and motor along with accessories shall be provided for sewage lifting stations. Each sewage lifting station shall have 2x100% capacity pumps. The pump capacity, head and total no. of pumps in the plant shall be finalized by the bidder based on number of sewage lifting stations in the power plant.
- 4.07.00 Other accessories to be supplied with the pump-motor sets are as follows :
- a) One discharge pressure gauge with 3 way SS isolating valve for each pump of Group-A and Group-D and all other instrumentation as required for safe and trouble free operation. Suction and discharge pressure gauge for Group-B pump.
 - b) All integral/internal piping, valves, fittings etc. for lubrication, cooling and sealing for each pump wherever required.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- c) All equipment, accessories and consumable required for erection, testing and commissioning.
- 4.08.00 All electrical equipment and accessories supplied shall meet the technical requirements covered under "Electrical Equipment and Accessories, Volume-V" of this specification.
- 4.09.00 All control & instrumentation complete with all accessories as addressed in technical specification of control & instrumentation Volume-VI of this specification.
- 4.10.00 Lubrication of one (1) initial fill and one additional fill after commissioning.
- 4.11.00 Rust inhibitor paint at Manufacturer's works.
- 4.12.00 Any additional accessories not mentioned hereinabove but specified in enclosed technical specification for sump pumps, as applicable and those indicated in sump pump data specification sheets and electric motor specification should also be supplied.
- 5.00.00 **DESIGN AND CONSTRUCTION**
- 5.01.00 The design, construction testing and other details of the sump pumps and related accessories shall be in line with the stipulations and data in this section and the lead specification (Vol. II A)
- 5.02.00 Each sump pump shall be equipped and coupled with a drive motor, with rating so selected as to have at least 15% margin over the maximum power required by the pump, throughout its range of operation. All other requirements of the drive motors shall be as stipulated in the Volume-V.
- The discharge rate of sump pump is uncontrolled. As such pump should be capable to operate even under a condition of as low as 25% of specified total head. Motors of group-B pumps should be designed to cater such eventuality.
- 5.03.00 All electrical items shall conform to the stipulations of Volume-V.
- 5.04.00 All piping shall be as per IS-1239 of medium or heavy grade (as suited for the maximum operating pressure) and shall be either galvanised or painted with approved rust inhibiting paint. Pipe size shall be as per Annexure-II. Any matching piece/reducer required to match the pipe with pump nozzle, hose, etc. shall be provided.
- 5.05.00 All valves shall be steel body type as per applicable IS/BS/ANSI standard, with pressure class compatible with the maximum working pressure.
- 5.06.00 All hoses shall be of steel wire reinforced type. Pump suction hose shall be suitable for working under vacuum. Pump discharge hose shall be suitable to withstand the maximum pressure that it may be subjected to in all working conditions, including hydrostatic testing of the sump pump discharge line.
- 5.07.00 Pump suction strainer shall have openings large enough just to permit the

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

entry of solids having maximum size as stipulated under clause no. 1.02.00.

- 5.08.00 Pressure gauges shall be of Bourdon type, with sealing diaphragm to prevent ingress of the working fluid. Selected range of pressure gauge shall be such that the entire range of working pressure covers about 1/3rd to 2/3rd to its range. Accuracy of measurement shall be within $\pm 1\%$ of scale range. The suction pressure gauge shall be compound type. Pressure gauge dial size shall be 100 mm or more.
- 5.09.00 **Pumps**
- 5.09.01 Pumps under Group-A shall be wet pit type, vertical shaft, centrifugal, vertical submerged suction, non-clog volute type complete with enclosed shaft, discharge pipe, head assembly thrust bearing and drive assembly, cover plates etc.
- 5.09.02 Pumps under Group-B shall be of horizontal shaft, single stage, end suction, radially split casing, centrifugal, non-clog design complete with common base plate, drive assembly etc. These pumps shall be trolley mounted portable type.
- 5.09.03 Pumps under Group-C shall be submersible pump-motor type, single stage and non-clog design and shall be portable type.
- 5.09.04 Pumps under Group-D shall be similar to Group-A pumps.
- 5.09.05 Casing
- a) Casing shall be so designed to allow free passage of specified maximum size of solid.
 - b) Casing shall be designed to withstand the maximum shut-off pressure developed by the pump.
 - c) The casings shall be cast, free from blow holes, sand holes, other detrimental defects. The casing shall be complete with suction and discharge connections.
 - d) For pumps under Group-A and Group-D adequate seal arrangement shall be made to keep leakage of liquid from casing to column assembly to minimum and adequate drain shall be provided in column assembly to permit escape of the leakage flow. The casing shall also include the bearing housing of the bottom pump shaft bearing.
 - e) Casing of pumps under Group-B shall be provided with vent connections and drain connections with valves. These pumps shall be manually primed.
- 5.09.06 Impeller
- a) The impeller shall be open/semi-open non clog type, cast in one piece and specially designed to pass large solids or unscreened liquids. The clearance between stationary and moving parts should be such

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

as to allow sustained performance without exclusive maintenance.

- b) Impellers of pumps under Group-A and Group-D shall have provision for adjustment from an accessible location and for pumps under Group-C shall be capable of passing fibrous material like cotton waste, jutes, etc.

5.09.07 Pump Shaft

- a) Shaft size selected shall be such that critical speed is at least 20% away from the operating speed and the runaway speed.
- b) The shaft shall be ground and polished to final dimension and of ample size to withstand all stresses resulting from rotor weight, hydraulic loads and across the line starting. Shaft shall be provided with renewable sleeves particularly under stuffing boxes and other locations as recommended by pump manufacturers.
- c) The coupling between shafts shall be so designed that they become tight during pump operation.

5.09.08 Column Pipe (for pumps under Group-A and Group D)

The discharge pipe shaft assembly shall be flanged or screwed as per manufacturer's standard and standard length of each piece of column pipe shall be in conformity to the shaft piece lengths from consideration of easy handling.

5.09.09 Bearings

- a) Adequate nos. of properly designed bearings shall be furnished. Bearings for pumps shall be antifriction type and lubricated by grease. Line shaft bearings of vertical pumps shall also be grease lubricated. All necessary grease gun, grease cup and tubing shall be included.
- b) Thrust bearing of adequate design shall be furnished for taking the entire pump thrust arising from all probable conditions of continuous operation through out its "range of operation" and also the shut-off condition. The life of thrust bearing shall be 20,000 working hour minimum for the load corresponding to the duty point. The bearings shall be lubricated by grease from a location conveniently accessible. Design shall be such that the lubricant cannot contaminate the handling liquid.

5.09.10 Wearing Ring/Liner Plate

Renewable wearing rings/liner plates shall be provided either on impeller or on the casing or on both impeller and casing.

5.09.11 Stuffing Box

Stuffing Box of pumps under Group-A and Group-D shall be of mechanical packing type. For pumps under Group-B and Group-C mechanical seal of

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

-
- reliable design shall be provided.
- 5.09.12 Coupling
- Pump and motor shall be connected with a suitable flexible coupling. Coupling shall be provided with coupling guard.
- 5.09.13 Mounting Plate for Group-A and Group-D Pumps and Base Plate for pumps under Group-B.
- Each pump under Group-A and Group-D shall be provided with a suitable mounting plate. The mounting plate shall be adequately sized to accommodate the level switches, discharge pipe, grease cups etc. if any. Pumps and motor under Group-B shall be mounted in one base plate. Base plate shall be of rigid construction properly ribbed as needed. Suitable drain with valve and drain funnel shall be furnished by the Bidder.
- The necessary supporting plate, mounting frame, base plate etc. as required shall be supplied under this specification, along with anchor bolts, foundation bolts, pipe, sleeves etc. Lifting lug, eye bolts, etc. as required for the proper handling of each pump set shall be furnished.
- 5.09.14 Suction Bell
- The pumps under Group-A, C and D shall be complete with adequately dimensioned suction bell to guide and streamline intake fluid.
- 5.09.15 Material of Construction
- For material of construction of various parts of data specification sheet -1 shall be referred to.
- 6.00.00 **INSPECTION AND TESTING**
- 6.01.00 All pumps shall be tested at the shop for capacity, head, efficiency and brake horse power. These tests are to be done according to the requirements of "Hydraulic Institute Standard" and as per MQP to be approved by Owner during detail engineering.
- 6.02.00 The pump integral accessories like thrust bearing, pump motor coupling etc. shall be subject to tests as per manufacturer's standard and / or applicable national / international standard.
- 6.03.00 Test on motors, control panels, starter panels, cables shall be conducted as per the requirement of Volume-V of this specification and as per MQP to be approved by Owner during detail engineering.
- 6.04.00 After delivery/erection at site, pumps shall be operated to prove satisfactory and trouble free performance.
- 6.05.00 In addition to these tests also refer lead specification Vol. IIA.
- 7.00.00 **DRAWINGS, DATA, INFORMATION REQUIRED**

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-1)

V.IIIF/S-I : 9

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

7.01.00	Location and dimension of all sumps which requires assisted evacuation, present in the areas covered under Main Plant Package.
7.02.00	General Arrangement drawing & Cross-sectional drawing of sump pump.
7.03.00	For Mandatory Spares, Spares required for erection and commissioning, Recommended Spares, Special Tools And Tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered and supply of first charge of lubricating oil, inhibitor oil and also adequate quantity of the consumables, please refer Technical Specification Volume-II A.
7.04.00	List of location of Group-A and Group-D pumps.
7.05.00	Characteristic curves of pumps showing effective head, pump input power, efficiency, submergence and NPSH, against capacity ranging from shut-off condition to 125% or rated capacity for Group A, B & D pumps and to 150% of rated capacity for Group C pumps.
7.06.00	Speed vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed vs. torque of the motor, corresponding to 80% and 100% rated voltage.
7.07.00	Diagram showing the type of lubrication system etc.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

ANNEXURE-I

DATA SPECIFICATION SHEET

		Group-A	Group-B	Group-C	Group-D
1.	Pumps				
1.1	Rated Capacity (Cu.M/hr.)	<----- Refer - II ----->			
1.2	Total Head at rated Capacity (MLC)	<----- DO ----->			
1.3	Nos. Required	<----- DO ----->			
1.4	Duty	<----- Intermittent ----->			
1.5	Pump Design Standard	<----- IS-5120/ IS:1710----->			
1.6	Parallel operation required	Yes	No	No	Yes
1.7	Material of Construction				
	a) Base plate/Cover Plate	<----- M.S. IS-2062 / Equivalent ----->			
	b) Column Pipe	<----- M.S. IS-2062 / Equivalent ----->			
	c) Casing	<----- 2% NiCl, IS-210, FG-260 (*)----->			
	d) Impeller	<----- 2% NiCl, IS-210, FG-260 (**)----->			
	e) Pump/Impeller Shaft	<----- SS. AISI-316 ----->			
	f) Shaft Sleeve	<----- SS. AISI-316 (Hardened) ----->			
	g) Shaft Coupling	<----- SS. AISI-410 ----->			
	h) Shaft Bearing	BUSH GM as per IS-306 Gr.1 / Equivalent			
	i) Gland	<----- C.I., IS-210, FG-260/Equivalent ----->			
	j) Gland Packing	<----- Braided Graphite-free Teflon --> ***			
	k) Fasteners coming in contact with water	<----- SS. AISI-304 ----->			
	l) Fasteners not coming in contact with water	<----- Carbon Steel ----->			

Note : * Alloy CI (min 30 mm thick) BHN 350 min
 ** Ni-hard (min 25 mm thick) BHN 550 min.

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-1)

V.IIIF/S-I : 11

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

		Group-A	Group-B	Group-C	Group-D
	*** S.S. Wire reinforced/impregnated graphite teflon.				
	m) Discharge pipe	MS IS-1239/Equivalent	--	--	MS IS-1239/ Equivalent
	n) Motor stool	<----- Close Grained C.I.----->			
1.8	Range of Operation	<----- Refer -II ----->			
1.9	Tests and Inspection	<-- As per Cl. No. 6.00.00 and lead specification -->			
1.10	Supply of Accessories & Services (Wherever Applicable) for each group and each rating of Pumps				
	a) Base plate		Yes		
	b) Sole Plate		Yes		
	c) Foundation bolts, nuts, sleeves etc.		Yes		
	d) Companion flanges with nuts, bolts & gaskets		Yes		
	e) Unions for external water for cooling/sealing/lubrication		Yes, if required		
	f) Cooling/ sealing/lubrication system with all accessories, complete with pipes, valves and with instruments		Yes, if required		
	g) Discharge pressure gauge		Yes		
	h) Suction pressure gauge		Yes, for Group-B only		
	i) Pump-motor coupling and guard		Yes		
	j) Eye bolts, lifting tackle etc		Yes		
	k) Pre-lubrication tank and accessories		Yes, if required		
	l) Suction bell		Yes		

ANNEXURE-II

SCHEDULE OF SUMP PUMPS

GROUP-A PUMPS : PERMANENTLY INSTALLED VERTICAL SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	These pumps should be located in the following areas as minimum : i) Power house ground floor sump pits near condenser ii) Underground conveyor tunnel in mill reject system iv) Any other places felt necessary by Bidder. These pumps will also be provided in all indoor sumps and outdoor sumps of capacity 5 cu.m.& above and	Two pumps (100% capacity) are to be located in each sump pit	Capacity of each pump should be so selected to empty the sump pit in 10 to 15 minutes	To be calculated with 10% margin over total dynamic head (TDH = static head + friction losses)	To be decided by the bidder	As described in cl. no. 1.02.01	Discharge pipe sizing should be done taking minimum water velocity to be 2m/sec but should not be less than 50 NB. One gate valve and one non return valve should be provided at pump discharge.

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-1)

V.IIIF/S-I : 13

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
	underground cable vaults (if any) except Ash Handling Plant.						

GROUP-B PUMPS : HORIZONTAL CENTRIFUGAL TROLLEY MOUNTED PORTABLE SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	Pumps will be used in various sumps of the plant area like fuel oil transfer and pressurising pump house	Two (2)	Ten (10) (Working Range: 0 to 125%)	Six (6)	To be finalised by the Bidder	As mentioned in clause no. 1.02.02	To be supplied with suction & discharge pressure gauge and other accessories as specified and shall be trolley mounted. Suction hose should be of 80 NB size. Discharge hose should be of 65 NB size.

GROUP-C PUMPS : VERTICAL SUBMERSIBLE PORTABLE SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	Pumps will be used in various deep sumps / pits (e.g. CW pump house, Clarified Water pump house, etc.) in case of eventuality.	Two (2)	100 (Working range as per pump characteristic curve for full range of head variation).	Twenty (20) (Range 5 to 25)	To be finalised by the Bidder	As mentioned in clause no. 1.02.03	To be supplied with discharge pressure gauge and 500 mm M.S. pipe spool at discharge as specified. Discharge hose should be of 100 NB size.

GROUP-D PUMPS : PERMANENTLY INSTALLED VERTICAL SUMP PUMP

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
1.	These pumps should be located in the Ash Handling Plant Buildings ii) Any other places felt necessary by the Bidder.	Two pumps (100% capacity) are to be located in each sump pit	Capacity of each pump should be so selected to empty the sump pit in 10 to 15 minutes	To be calculated with 10% margin over total head (TDH = static head + friction losses)	To be decided by the Bidder	As described in cl. no. 1.02.04	Discharge pipe sizing should be done taking minimum water velocity to be 2m/sec but should not be less than 80 NB. one gate valve and one non return valve should be provided at pump discharge.

**Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

Sl. No.	Location	Numbers required (Total)	Capacity (cum/Hr.) Each	Total head (MLC)	Pit size in which pumps are to be installed (in mm)	Type of liquid to be handled	Remarks
	These pumps will also be provided in all indoor sumps and outdoor sumps of capacity 5 cu.m and above.						

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-1)

V.IIIF/S-I : 16

Telangana State Power Generation Corporation Ltd.
Kothagudem TPS Stage -VII, Unit #12 (1X800 MW)

EPC Bid Document
e-PCT/TS/K/02/2014-15

ANNEXURE-II

DATA SPECIFICATION SHEET OF SEWAGE TRANSFER PUMP

1.0	Number required in each sewage lifting station	Two (2) [One working and one stand-by].
2.0	Type	Vertical Submersible
3.0	Location	Outdoor
4.0	Fluid to be handled	Sanitary Waste water
5.0	Duty	Continuous
6.0	Suction Condition	Flooded suction
7.0	Rated capacity, m ³ /hr	By Bidder
8.0	TDH at rated capacity, MLC	By Bidder
9.0	Range of Operation (%)	30-120
10.0	Pump Speed, RPM	1500 preferred
11.0	Material of Construction	
	• Casing	SS 316
	• Impeller	SS 316
	• Shaft	SS 316

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

VOLUME : III-C

SECTION-XII

**GENERAL TECHNICAL REQUIREMENT
FOR
SCREW PUMPS**

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	GENERAL	1
2.00.00	CODES AND STANDARD	1
3.00.00	TECHNICAL REQUIREMENTS	1
4.00.00	TEST	6

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

SECTION-XII

TECHNICAL SPECIFICATIONS FOR SCREW PUMPS

01.00.00 GENERAL

This section covers general requirement of design, construction features. manufacture, inspection and performance testing of screw / gear pump for water, oily water, fuel oil and sludge applications.

2.00.00 CODES AND STANDARDS

The equipment supplied shall comply with the latest applicable Indian Standards listed below. Other national standards are acceptable provided they are established to be equal or superior to the Indian Standards mentioned herewith.

IS : 5120. 1977	Technical requirements of rotodynamic purpose pumps
BS : 599. 1966	Method of testing for pumps
HIS	Hydraulic Institute Standards, USA
API: 676. 1980	Positive Displacement Pumps - Rotary
VDMA 24284. 1970	Positive Displacement Pumps - Code for Acceptance
	Test
IS: 210.1993	Grey Iron Castings
IS : 2062, 1992	Steel for general structural purposes
ANSI B16.5	Pipe flanges and flanged fittings
ASME Sec II	Engineering
	Materials

03.00.00 TECHNICAL REQUIREMENTS

03.01.00 Design & Performance Requirements

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-V-IIIC-Sec-XII.doc)

V.III-C/S-XII: 1

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 03.01.01 The pump shall be horizontal, rotary, positive displacement type with gear or screw as rotary element.
- 03.01.02 The pump shall be capable of developing the required total head at rated flow under continuous operation. The maximum efficiency of the pump shall be within $\pm 10\%$ of rated flow.
- 03.01.03 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load sharing. Components of identical pumps shall be Interchangeable.
- 03.01.04 Pumps shall run smoothly without undue noise and vibration. The noise level at a distance of 1 m from the equipment shall not exceed 85 dBA.
- 03.01.05 The pumps shall be suitable to handle fluid of characteristics as indicated in technical data sheet.
- 03.01.06 The pumps shall be suitable to handle the specified fluid for the complete range of operating conditions. The pump capacity shall be selected based on lowest possible viscosity and driving motor power shall be selected based on highest possible viscosity.
- 03.01.07 Each pump shall be connected to its drive motor directly and shall be mounted on a common base plate. The pump set along with drives shall be designed to permit rapid and economical maintenance.
- 03.01.08 All pumps shall be provided with suitable mechanical seals of proven design and material.
- 03.01.09 The supplier shall assume full responsibility in the operation of pump and motor as a unit.
- 03.02.00 Construction Requirements
- 03.02.01 Pump Casing
 Casing and supports shall be designed to have sufficient strength and rigidity to prevent any adverse effect on internal clearances and to limit change of alignment to 50 micrometers at the coupling

flange caused by the worst combination of pressure, torque or allowable piping stress.

Pump casing shall be provided with a vent connection along with piping, fittings & valves unless pump is self-venting by the arrangement of nozzles. Casing drain, as required, shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature.

Jacket for cooling or heating shall be provided, if specified in technical particulars. Passages shall not open into casing joints.

Inlet and outlet connections shall be flanged. Flanges shall be raised face and shall conform to ANSI B 16.5. Counter flanges with necessary bolts, nuts, gasket etc. shall be supplied along with the pump.

03.02.02 Rotating Elements

Rotating parts shall be properly aligned. Rotor and shaft shall be stiff enough to prevent contact between the rotor bodies and the casing. It shall be of material that have wear, corrosion and erosion resistance compatible with the application.

03.02.03 Mechanical Seals

The Pumps shall generally be employed with mechanical seals, which shall be arranged that replacement of seal should be possible with minimum downtime. T sealing faces should be highly lapped surfaces of materials known for their frictional coefficient and resistance to corrosion against the liquid being pumped

The seal end plate or rotating cover and bolting shall be designed to retain the SI with sufficient rigidity to prevent distortion that might impair seal operation. T stationary seal member shall be positively retained to prevent its rotation. For 1 seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating.

If seal flushing and cooling is provided by the pumped fluid, the pump supplier shall ensure that sufficient flow reaches the primary seal faces to provide for cooling and maintenance of a stable film at

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

the seal faces.

03.02.04 Stuffing Box

Stuffing box, if provided, should permit replacement of packing without removing any part other than the gland. Asbestos shall not be used as a packing material.

Stuffing Boxes of packed ring construction type preferably to accommodate five rings of packing (minimum four rings of packing) plus a lantern ring shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. or the gland sealing connection.

03.02.05 Bearing

Heavy duty antifriction bearings, adequately designed for the type of service specified in the technical data sheet and for long, trouble free operation shall be furnished.

The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. Antifriction bearings shall be designed for a rated life of either 25000 hours with continuous operation at rated conditions or 16000 hours at maximum axial and radial loads and rated speed.

Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearing assembly.

Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

03.02.06 Pump & Motor shaft Coupling

The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.

03.02.07 Base plate

A common base plate for the pump and motor shall be provided. The base plate shall be of fabricated steel (minimum 6 mm thickness) and of rigid construction suitably ribbed and reinforced. Base plate and pump supports shall be constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. The base plate shall be suitably drilled for the anchor bolts. The base plate shall have drip pan and suitable draining arrangement.

03.02.08 Relief Valve

To protect against damage due to accidental closure of discharge valve, each pump shall be provided with a relief valve of adequate capacity,

Relief valve shall be able to handle the pump rated capacity when fully open, at a pressure not more than 10 percent above the set pressure.

03.02.09 Material of Construction

The material of construction of various components shall be as indicated in technical particulars. These are to be considered as minimum requirement and it is the responsibility of supplier to select and offer proper material of construction for the required service,

03.02.10 Assembly and Dismantling

Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouted base plate or alignment.

03.02.11 Drive Motor

The motor shall be sized to meet the maximum specified operating conditions. including external gear and/or coupling losses. Continuous Motor rating (at 50 ° C ambient) shall be atleast ten percent (10%) above the maximum load demand of the pump in the entire operating range including the run out condition to take care of the system frequency & voltage variation.

The enclosure of motor shall comply various requirements of flame proof construction as per IS-2148 and degree of protection shall be as per IP-55.

Other design and construction features of the drive motor shall be as specified, elsewhere, under Standard Electrical Specifications.

4.00.00 TESTS

Material test certificates from recognized laboratories shall be furnished for review\for various components.

Following are the minimum shop and site tests to be conducted by the supplier:

4.01.00 Shop Tests

4.01.01 Hydrostatic Test

Pressure containing parts, including cooling and heating jackets, shall be test hydrostatically with liquid at a minimum of 1.5 times the maximum allowable working pressure but at not less than 1.38 bar gauge.

Tests shall be maintained for a sufficient period of time to permit complete examination of parts under pressure. The hydrostatic test shall be considered satisfactorily when no leaks are observed for a minimum of 30 minutes.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS****EPC Bid Document
e-PCT/TS/K/02/2014-15****4.01.02 Mechanical Balancing**

All rotating components of the pumps shall be subjected to static and dynamic balancing at shop as per ISO 1940. The dynamic balancing shall be done at or near the operating speed and the supplier shall furnish its acceptance norms for approval before conducting the test.

4.01.03 Non-destructive Testing

Non-destructive testing of the pump components shall be conducted in accordance with relevant standards. Prior to testing, the test procedure and repair procedure shall be submitted for approval. All components subjected to testing shall be identified and only those which are tested successfully shall be used for the manufacture of final product. All test results shall be submitted by the supplier for approval

All cast iron parts shall be tested in accordance with IS - 210. Test bars shall be cast or physical tests from the same ladle of metal as the casting they represent.

Steel forgings used in pump shall be tested for both physical properties and chemical composition. steel forgings shall be ultrasonically tested.

4.01.04 Performance Testing

All pumps shall be performance tested at the Manufacturer's Works as per testing code. The test shall be conducted to determine the following characteristics:

- a) Speed
- b) Discharge Pressure
- c) Suction Pressure
- d) Capacity
- e) Power

The test shall be conducted preferably with the tested job motor.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

04.02.02 Noise and vibration shall be measured during the performance testing, for reference purposes.
For pumps operating in parallel, the load sharing should not vary by more than 5%.

The pumps showing any abnormal behaviour during the performance testing or the pumps as required shall be stripped down for a thorough examination after the performance test. The performance test report shall be prepared by the supplier and submitted for approval, before despatch of the pumps.

04.02.00 Site Tests

04.02.01 After installation, the pumps supplied shall be operated to prove satisfactory performance as individual equipment as well as a system. The noise and vibration level of the pumps shall be measured and it should be within the design values. For pumps operating in parallel, the load sharing should not vary by more than 5%. If performance at site is found to be unsatisfactory, then the supplier shall rectify or replace the equipment.

04.02.03 Test Procedure Instruments

The test procedures to be followed and instruments to be used for testing shall be subject to the approval. All instruments to be used for stage and performance testing shall be calibrated at reputed third party laboratories.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

VOLUME : IIIF

SECTION-III **GENERAL TECHNICAL REQUIREMENT FOR** **MISCELLANEOUS HOISTS**

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-3)

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES AND STANDARDS
3.00.00	SCOPE OF WORK
4.00.00	SPECIFIC DESIGN REQUIREMENTS
5.00.00	DESIGN AND CONSTRUCTION
6.00.00	INSPECTION AND TESTING
7.00.00	DRAWINGS, DATA AND INFORMATION

ATTACHMENT

ANNEXURE-I	LIST OF LOCATION FOR MONORAIL HOISTS

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

VOLUME : IIIF

SECTION-III

MISCELLANEOUS HOISTS

1.00.00 GENERAL INFORMATION

1.01.00 The hoists will be used for erection and maintenance of various equipment in different buildings.

1.02.00 Hoists are divided into two separate groups - (a) Hand operated and (b) Electric operated.

2.00.00 CODES AND STANDARDS

The design, manufacture and testing of the equipment covered under this specification shall conform to the latest editions of the following Indian Standards:

2.01.00	IS : 3832	:	Specification for Hand Operated Chain Pulley-blocks.
2.02.00	IS : 807	:	Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists.
2.03.00	IS : 6216	:	Short link Chain, Grade T(8) for Pulley-blocks & other Lifting Appliances.
2.04.00	IS : 4164	:	Lifting 'C' Hooks with Eye Capacity upto 25 tonnes.
2.05.00	IS : 2429 (part -I)	:	Non-calibrated Load Chain for Lifting Purposes.
2.06.00	IS : 3938	:	Specification for Electric Wire Rope Hoists. and other Indian Standards referred to in the above standards.

3.00.00 SCOPE OF WORK

3.01.00 Hoists shall be provided in all areas where any equipment/component weighing above 500 kg is installed and needs to be handled for maintenance purposes. Number of monorail beams shall be such that the centre line of the hoist and the centre line of equipment to be handled shall be not more than 500 mm.

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-Vol IIIF-Sec-3)

V.IIIF/S-III : 1

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

3.01.01	The location and no. of hoists is to be finalised during detailed engineering. Final arrangement is subject to approval of Owner/Consultant.
3.01.02	Monorail hoists shall at least be provided in the areas mentioned in Annexure-I. The list is indicative only and not an exhaustive one.
3.02.00	All drive motors and driving gears as necessary.
3.03.00	Limit switches for electrical hoist as necessary.
3.04.00	Trailing cable with all supporting fixtures as necessary for electric hoists.
3.05.00	Pendent control station with all accessories for electric hoists.
3.06.00	Lifting lug, eye bolts etc., for handling hoist parts.
3.07.00	Protection guard as specified.
3.08.00	Lifting hook block assembly for hoists.
4.00.00	SPECIFIC DESIGN REQUIREMENTS
4.01.00	Lifting capacity
4.01.01	Capacity of each hoist shall be 1.2 times the maximum working load.
4.01.02	Hoists of capacity upto 5 tones shall be manual hoists. Hoists of capacity above 5 tones shall be electric hoists.
4.02.00	Effort for Mechanical Hoists
4.02.01	Hoisting Hoisting effort for hoists upto 3 tones capacity shall not be more than 20 kg. Hoisting effort for hoists above 3 tones capacity shall not be more than 25 kg
4.02.02	Trolley Motion Effort for trolley motion for hoists upto 3 tones capacity shall not be more than 15 kg. Effort for trolley motion for hoists above 3 tones capacity shall not be more than 20 Kg.
4.02.03	For Electric operated hoist both hoisting and trolley motion shall be motor operated.
4.03.00	Lift

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 4.03.01 Lift above operating floor
- Highest position of the hook shall be such that during operation of hoists, the vertical distance between bottom of any equipment handled and top of any permanent structure or equipment in the operating area shall be at least one metre.
- 4.03.02 Approach below operating floor
- To be decided by the Bidder for safe and reliable handling of any equipment above half ton below the operating floor.
- 4.04.00 **Length of Monorail Hoist**
- To be decided by the Bidder depending on the floor and machine layout. The horizontal distance between the centre line of the hoist and centre line of any installed equipment in its operating shall not be more than half metre.
- 5.00.00 **DESIGN AND CONSTRUCTION**
- 5.01.00 All parts requiring replacement or lubrication shall be easily accessible without the need for dismantling of other equipment and structures.
- Robust construction and ample rating merging which experience has shown to be necessary shall be ensured throughout manufacture.
- 5.02.00 All components of hoists of identical capacity and duty shall be interchangeable. The hoists of identical capacity and duty shall be identical in all respects unless otherwise required. The hoist design shall be such that these can be quickly removed from one monorail beam and fixed on another beam without disassembling major components.
- 5.03.00 All machinery and equipment included under this specification must be equipped with safety devices and clearances to comply with recognized standards and specification requirements.
- 5.04.00 Cast iron parts wherever used, shall conform to IS:210 - FG 260. Also no wood or other combustible materials shall be used.
- 5.05.00 Defects in material like fractures, cracks, blowholes, laminations, pitting etc. are not allowed. Rectifications of any such flaw is permissible only with the approval of the Purchaser.
- 5.06.00 Each hoist shall be permanently and legibly stamped with the tag number, manufacturer's name, safe working load, grade of load chain (where applicable), range of lift etc.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 5.07.00 Load chain (where applicable) shall be of grade T(8) as per IS:6216 and Hand chain shall be as per IS:2429 (Part-I) grade 30.
- 5.08.00 Wheels in trolley unit travel shall be single flanged with straight/tapper/barrel shaped tread to suit the monorail. Wheels should be preferably of forged steel construction. Material of construction for wheels of traversing block and hoist gear for hoist used in hazardous areas shall be of non-ferrous material to avoid spark during operation.
- 5.09.00 All gears shall be hardened and tempered steel with machine cut teeth.
- 5.10.00 **Hoist (Manually Operated)**
- 5.10.01 Manually operated hoists shall be of spur gear chain pulley block type. It shall be suspended from the trolley by a hook. The design of the hoist shall conform to IS:3832 (Specification for hand operated chain pulley blocks). The hooks and brakes of hoist shall conform to the requirements stipulated in (a) and (b) below
- a) Hooks shall conform to and IS:3832. The load hook shall be swivelling type fitted with a locking device.
 - b) The pulley blocks shall be fitted with an automatic mechanical load brake to prevent self lowering of load in all working positions. The load brake shall also allow smooth lowering of load without serious overheating.
 - c) All manually operated hoists, unless stated otherwise, shall be trolley suspended type.
- 5.10.02 The trolley of hoists shall be manually operated.
- 5.10.03 The hoists shall be of Mechanism class 2 as per IS:3832.
- 5.11.00 **Electric Hoist**
- 5.11.01 Electric hoist shall be electric wire rope trolley suspended type. The design, operation, testing of electric hoist shall conform to IS:3938 (Specification for electric wire rope hoist).
- Minimum speed for hoisting shall be 3 m/min. and that of for trolley motion shall be 15 m/min.
- 5.11.02 Lifting hook shall conform to IS-4164 as applicable.
- 5.11.03 Wire rope for hoists shall conform to IS-2266.
- 5.11.04 Electro-mechanical brakes of fail to safety type shall be provided for hoist motion as well as per trolley motion for electrically driven trolley. Load brake shall allow smooth lowering of load and arrangement shall be such as it can not be released accidentally. Capacity of brake and other relevant data shall conform to IS:3938.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 5.11.05 The trolley of the hoists shall be electrically driven.
- 5.11.06 For other components of hoist such as rope, sheave, drum, bearings, gears etc. stipulations of IS: 3938 shall be followed.
- 5.11.07 Motor shall be rated for duty S4. Service class of motor shall be "M8" as per IS:3177. Conditions given in IS:3938 for hoist motor shall be followed over and above the specification of electric motor in Volume-V. In case of any contradiction of the aforesaid standard and the motor specification, the conditions which are more stringent shall be considered. All the motors shall be suitable for reversing, frequent starting and braking. Motors shall be provided with suitable space heating arrangement.
- 5.11.08 Hoist shall be designed so that remote control can be effected by means of pendant push button switch from the operating floor. Operation, arrangement etc. of pendant push button switch shall conform to IS:3938.
- 5.11.09 Micro-speed attachment in hoist shall be provided if considered necessary by the Bidder.
- 5.11.10 The hoists shall be of mechanism class 2 as per IS-3938.
- 5.12.00 Ball and roller bearings of reputed make shall be used throughout.
- 5.13.00 Suitable lubrication system shall be provided for all gear drives.
- 5.14.00 **Other Electrical Items**
- 5.14.01 The cross conductor on monorail for power supply to the hoist shall be of festoon type flexible insulated cable conductors. All fixtures and accessories shall be provided by the Bidder for this purpose.
- 5.14.02 Necessary insulators, supports, clamps and all other accessories shall be provided as per standard design.
- 5.14.03 Each hoist shall be provided with a starter panel with protective relays.
- 5.14.04 One main isolating switch shall be used to cut-off the supply to the hoist assembly.
- 5.14.05 One main electro-magnetic contactor together with magnetic overload relay (hand reset) for each motor circuit shall be housed in the protection panel.
- 5.14.06 The operation of overload relay shall interrupt the main magnetic contactor.
- 5.14.07 Adequate short circuit protection shall be provided for main and individual circuits.
- 5.14.08 415V $\pm$ 10%, 3 Phase, 4 Wire, 50 Hz $\pm$ 5%, power supply for the hoist shall be arranged through MCCB unit mounted at standing height at a convenient location near each hoist.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 5.14.09 Transformers to step down the voltage and rectifiers as necessary shall be provided by the Bidder.
- 5.14.10 All external and internal power, control and auxiliary circuit wiring of the electrical drive and accessories and panels shall be provided. The wiring shall be done with 1100 V grade PVC insulated stranded aluminium conductor cable of suitable size not less than 2.5 sq.mm nominal equivalent copper area of cross-section. All control and auxiliary circuit wiring shall be done with 1100 V grade PVC insulated, 2.5 sq.mm stranded copper conductor. Control wire terminations to the panels shall be made with compression type connectors. Multiway terminal blocks shall be furnished for terminating panel wiring and outgoing cable.
- 5.14.11 The hoist structure, motor frame and metal cases of all electrical equipment including metal conduit shall be effectively connected to earth. All grounding materials shall be supplied under this specification to grounding risers.
- 5.14.12 Single speed control shall be used for both hoist and trolley travel in each direction of motion.
- 6.00.00 **INSPECTION AND TESTING**
- 6.01.00 The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of the specification and in compliance with the requirements of the latest edition of IS:3832 or equivalent standards for manually operated hoists and shall be as per IS:3938 for electrically operated hoist.
- 6.02.00 All the mono-rail hoists shall also be tested at site as per the stipulation of relevant Indian Standards.
- 7.00.00 **DRAWINGS, DATA AND INFORMATION**
- 7.01.00 General arrangement drawings incorporating all dimensions information on head rooms, lift, wheel loads, hook suspension arrangement and other relevant data for all the hoists.
- 7.02.00 For Mandatory Spares, Spares required for erection and commissioning, Recommended Spares, Special Tools And Tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered and supply of first charge of lubricating oil, inhibitor oil and also adequate quantity of the consumables, please refer Technical Specification Volume-II A.
- 7.03.00 Design calculation for selection of electric motor capacities for electric hoist.
- 7.04.00 Complete list of location, number and capacity of hoists provided.

ANNEXURE-I

LIST OF LOCATION FOR MONORAIL HOISTS

1. **Power House**
 - a) For all equipments above 500 Kg in ground floor and mezzanine floor.
 - b) A/C Plant Equipment Room Area.
2. Fuel Oil Pressurizing Pump House.
3. FO Transfer Pump House.
4. Condensate Transfer Pump House.
5. C. W. Pump House Electrical Room.
6. **Boiler Area**
 - a) I.D. fan, motor & VFD.
 - b) F.D. fan, motor.
 - c) P.A. fan, motor.
 - d) Mills & gear boxes.
 - e) Air heater areas.
6. E.S.P. Transformer Rectifier Sets.
7. Electrical Switch Gear Rooms.

Note:

1. The above requirement of Hoist is minimum and any other area not specifically mentioned above where requirement may arise, shall be finalised during detail engineering.
2. For Coal Handling System, Ash Handling System and Water and Effluent treatment system refer relevant section of the specification.

VOLUME : IIA

SECTION-VII

GENERAL QUALITY ASSURANCE REQUIREMENTS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	QUALITY ASSURANCE PROGRAMME
2.00.00	GENERAL REQUIREMENTS QUALITY ASSURANCE
3.00.00	QUALITY ASSURANCE DOCUMENTS
4.00.00	INSPECTION, TESTING & INSPECTION CERTIFICATES

ATTACHMENTS

ANNEXURE-I	FORMAT OF QUALITY ASSURANCE PROGRAMME
ANNEXURE-II	FIELD WELDING SCHEDULE

VOLUME : IIA

SECTION-VII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 QUALITY ASSURANCE PROGRAMME

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following :

- a) His organisation structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.
- c) Qualification data for Bidder's key personnel.
- d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and all site related works.
- h) Control of calibration and testing of measuring and testing equipments.
- i) System for quality audit.
- j) System for indication and appraisal of inspection status.
- k) System for authorising release of manufactured product to the Owner.
- l) System for handling storage and delivery.
- m) System for maintenance of records.

- n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section for Owners approval
- o) Internal standards, if referred in the quality plans shall generally be compatible with National / International standards and shall be mentioned in the quality plans. Alternatively bidder shall furnish extracts of the internal standards detailing out acceptance norm for the product / material.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

Contractor shall furnish list of Manufacturing Quality Plans of major equipments indicating proposed inspection categorisation indicating items that will be offered for Owner's inspection etc and the Field Quality Plans

2.02.00 Manufacturing Quality Plan for all the major equipment will detail out their respective important components, their in-process various tests/inspection & final inspection / tests, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization. The relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing are to be comprehensively documented by Contractor.

Manufacturing Quality Plan for all major equipments/ items will be approved by owner. In these approved quality plans, Owner / Authorised representative shall identify customer hold points (CHP), test / checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work shall not proceed without consent of Owner / Authorised representative in writing. Inspection/ Test reports are to be submitted to owner as specified in final approved Manufacturing Quality Plans.

2.03.00 Field Quality Plans / Procedures for all field activities shall be submitted to

owner for review / approval. These Quality Plans / procedures will detail out, for all equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/ equipment at site.

- 2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and major deviations in the form of Non Conformity Report shall be referred to Owner/Authorised representative for approval and dispositioning.
- 2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative for "CHP" and "W" points marked in quality plans , and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC). For items which is not under owner's inspection the contractor shall apply for despatch clearance (MDCC) from owner by submitting their internal inspection reports and quality records
- 2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet serial numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.
- 2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.
- 2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section - IX (latest edition) or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX (latest edition) or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner / his authorised representative or owner approved Third Party Inspection Agency(TPIA). Previously qualified WPS & PQR shall be acceptable if witnessed by owner's approved TPIA.

For welding of pressure parts and high pressure piping coming under IBR purview, the requirements of IBR shall also be complied with.

- 2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with LIST OF STANDARDS FOR REFERENCE as given below in this section.

The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non-destructive examination). Results of NDT for the list major equipments / items identified for owner's inspection shall be properly recorded and submitted for review and approval. Other items not covered under owner's inspection, contractor shall review and approve the NDT results and such reports shall be submitted to owner in the final documentation of the items / equipments

- 2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

- 2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

- 2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

- 2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

- 2.14.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 **QUALITY ASSURANCE DOCUMENTS**

- 3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms / CDs of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

- a) Material mill test reports on components as specified by the specification.

- b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.
- f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- g) Stress relief time temperature charts.
- h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :
 - i) When some important repair work is involved to make the job acceptable.
 - ii) The repair work remains part of the accepted product quality.
- i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

4.01.00 The Owner's Engineer, or his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access inside the workshops, test labs, establishments at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Owner's Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.02.00 The Contractor shall give the Owner's Engineer/ Authorized Inspector twenty one (21) days written notice for "CHP" / "W" points of any material being ready for testing by owner' engineer / Authorized inspector. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/ Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection. If owner's Engineer / Authorised Inspector fail to attend the inspection, next mutually convenient date for test shall be agreed with Contractor. Contractor shall, in

no case proceed with the test without owner or his authorized inspectors, unless the witnessing is officially waived and advised Contractor to proceed with the test. Contractor shall forthwith forward duly certified completed test report and a product quality certificate in six (6) copies to owner upon completion of such test.

- 4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract / QAP or other approved quality documents. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract / QAP or other approved quality documents.
- 4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests excluding the test completion date subject to submission of all certified documents related to the test, If the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the owner's Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract / QAP or other approved quality documents.
- 4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the owner's Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract / QAP or other approved quality documents. Contractor and shall give facilities to the owner's Engineer/ Inspector or to his authorised representative to accomplish testing.
- 4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating proposed schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

LIST OF STANDARDS FOR REFERENCE

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers(ASME)
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).
- x) Electric Power Research Institute (EPRI).
- y) Standards of Manufacturer's Standardization Society (MSS)

- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Dept. of Environment, Govt. of India
- hh) Central Board of Irrigation and Power (CBIP) Publications

ANNEXURE-I
FORMAT OF QUALITY ASSURANCE PROGRAMME

VENDOR'S LOGO , NAME & ADDRESS		MANUFACTURING QUALITY ASSURANCE PLAN		DOC NO: XXXXX-CAL-QAP-M-0001	
ITEM : -				REV NO : 0 1 2 3 4	
		LOCATION :		DATE :	
CLIENT :		REFERENCE PURCHASE ORDER NO. & DT :			
PROJECT :		REFERENCE APPROVED DATA SHEET :			
VENDOR :		REFERENCE APPROVED DRAWING. NO. :			
SUB VENDOR :					
ABBREVIATIONS : QAP - QUALITY ASSURANCE PLAN, CR - CRITICAL, MA - MAJOR, MI - MINOR SPEC - SPECIFICATION, TC - TEST CERTIFICATES P - PERFORM W - WITNESS V - VERIFY CHP - CUSTOMER HOLD POINT		AGENCY : 1 - DCPL/PROJECT AUTHORITY 2 - SUPPLIER 3 - SUB-SUPPLIER 4 - MANUFACTURER 5 - THIRD PARTY INSPECTION AGENCY		GENERAL REMARKS 1 THE ITEMS WHICH ARE FALLING UNDER ANY STATUTORY AUTHORITY'S (LIKE I.B.R. ETC.) SCOPE SHALL BE SUBJECTED TO THAT STATUTORY AUTHORITY'S INSPECTION CLEARANCE.	
NOTES: 1. EXACT MATERIAL / PROCESS / INSPECTION / TESTS FOLLOWED BY THE MANUFACTURER SHALL BE SPECIFIED 2. EXACT REFERENCE DOCUMENT/ACCEPTANCE STANDARD SHALL BE SPECIFIED 3. IN CASE SPECIFIED ACCEPTANCE STANDARD / NORMS IS OTHER THAN NATIONAL / INTERNATIONAL STANDARDS . STANDARD / COPY OF THE ACCEPTANCE NORMS FOLLOWED BY THE MANUFACTURER SHALL BE SUBMITTED FOR REVIEW RECORD 4 FINAL INSPECTION DOSSIER SHALL BE PREPARED BY MANUFACTURER & SHALL BE ENDORSED BY INSPECTIONION AGENCY		Checked by		Approved By	
Revision	R0	R1	R2	R0	R1
DATE					R2

ANNEXURE-II

FIELD WELDING SCHEDULE

PROJECT : FWS NO :
 CONTRACTOR : REV NO. :
 PACKAGE : FIELD WELDING CODE :
 SYSTEM : PAGE NO. :

SI No.	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Pre-heat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method	NDT Specification Number	Acceptance Norm Ref.	Remarks

The Field Welding Schedule should be submitted for :

- ☐ Pressure Parts
- ☐ Tanks/Vessels
- ☐ Piping
- ☐ Heavy/Important Structural Steel
- ☐ Heat Exchangers
- ☐ Bus Ducts

VOLUME : III-C

SECTION-XIII

GENERAL TECHNICAL REQUIREMENT

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	GENERAL REQUIREMENTS	2
4.00.00	EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER	4
5.00.00	COATING PROCEDURE AND APPLICATION	7
6.00.00	TEST REQUIREMENTS	8
7.00.00	INFORMATION / DATA REQUIRED	12

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

DEVELOPMENT CONSULTANTS
(e-PCT-TS-K-02-2014-15-V-III-C-Sec-XIII.doc)

V.III-C/S-XIII: 1

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 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**

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

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.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

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

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

5.02.00 Application of Epoxy Coating

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

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

5.03.00 Application of PU Coating

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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) :

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**

**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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.

VOLUME : IIIB

GENERAL TECHNICAL REQUIREMENT

FOR

PLANT WATER SYSTEM & POTABLE WATER PUMPS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	INTRODUCTION
2.00.00	SYSTEM DESCRIPTION
3.00.00	CODES AND STANDARDS
4.00.00	SCOPE OF SUPPLY
5.00.00	GENERAL DESIGN AND PERFORMANCE REQUIREMENTS
6.00.00	DESIGN AND CONSTRUCTION
7.00.00	CONTROL & INSTRUMENTATION
8.00.00	INSPECTION AND TESTING
9.00.00	DRAWINGS, DATA, CURVES AND INFORMATION

ATTACHMENT

ANNEXURE-I	RECOMMENDED VELOCITY CHART FOR PIPE SIZING
ANNEXURE-II	DATASHEET FOR HORIZONTAL PUMPS
ANNEXURE-III	DATASHEET FOR VERTICAL PUMPS

VOLUME : IIIB

TECHNICAL SPECIFICATION FOR PLANT WATER SYSTEM

1.00.00 INTRODUCTION

This section presents the general description, basic design criteria and performance requirements, broad scope of supply and Instrumentation & Control of the following Plant water systems to be provided for 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 would be set up by Telangana State Power Generation Corporation Ltd. (TSGENCO) at Kothagudem, Telangana.

1.01.00 Raw Water Transportation System

1.02.00 Clarified Water Transportation System

1.03.00 DM Water Transportation System

2.00.00 SYSTEM DESCRIPTION

Consumptive water for 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12, will be made available by pumping from Godavari river water through existing pump house located at Burgumpahad and existing GRP pipe line to Plant raw water reservoir of capacity 150000 m³ which is sufficient for 3 days. The existing GRP pipe line passing through the new plant area will be re-routed using MS pipe line by TSGENCO. Tentative alignment proposal will be finalised by TSGENCO. TSGENCO shall take care of re-routing the same during detail engineering. Inside diameter of GRP pipe line is 1200 mm. New MS pipe used shall be of same diameter of 10 mm thick. The approximate length of GRP pipe to be replaced is 1.50 KM and the length of new proposed MS line which will be finalized during detailed engineering to avoid fouling will be of approximate 2KM length.

River raw water will be utilized to produce clarified water through clarifier. Finally clarified water will be stored in the Clarified water storage tank. Clarified water will be used as cooling water for main turbine condenser and the auxiliary cooling water system and its make-up, DMF input, Potable Water Treatment Plant input. It shall also be used make-up water for AC and Ventilation and other misc. purpose.

Total River raw water requirement is estimated at about 2192 cum/hr and total clarified water requirement is estimated as 2189 cum/hr. The water Balance Diagram is shown in Drg. No. 13A06-DWG-M-001Q. The scheme for Plant water System is presented in Drg. No. 13A06-DWG-M-001R.

2.01.00 **Raw Water Transportation System**

Raw water will be pumped through 3 (2W+1S) 1350 cu.m/hr capacity vertical pumps to clariflocculator. After pre-treatment, clarified water will be stored in the clarified water storage tank. A tap off line shall be taken from raw water pump main discharge header for ash water sump. This line shall be used for first 1-2 years after plant commissioning, after getting recycled ash water from ash pond; this line may be used intermittently as per system requirement.

The pump house shall be constructed and sized by the contractor as per stipulation of BHRA and Hydraulic Institute, which is subject to approval of Owner/Consultant during detail engineering stage. MCC/Control Room for the pumping station shall be suitably located adjacent to the pump house. Raw water pump house shall be made with balancing chamber.

2.02.00 **Clarified Water (CLW) Transportation System**

The clarified water from discharge of clarifier will be stored in Clarified water storage tank.

The Clarified water system shall cater the following services:

- i) Cooling Tower make-up
- ii) Service water
- iii) DMF Plant
- iv) Drinking/ Potable water
- v) APH/ESP wash

2.02.01 **Cooling Tower Make-up**

Clarified water will be transferred to the Cooling water (CW) system for Cooling Tower make up from Clarified water storage tank by means of Two (2) numbers (one working & one stand by) vertical centrifugal type CT make-up pumps.

2.02.02 **Service water**

Two (2) - (1 working + 1 standby) 100% capacity adequate head service water pumps of vertical type to supply clarified water to service water distribution network all over the plant building through a minimum 300 cum capacity RCC overhead tank suitably located at a suitable height in the Power Plant. Each pump capacity shall be of capacity 160 M3/hr. Service water system shall cater the following services:

- i) Quenching water for unit flash tank and MRH system
- ii) Seal water in vacuum pump house, ash slurry pump house and clinker grinder seals

- iii) AC make-up in ESP control room building and turbine building
- iv) Service water for chemical house
- v) Service water for plant building washing and toilets
- vi) Fire water

2.02.03 Drinking water/ Potable water

Two (2) – (1 working + 1 standby) 100% capacity water pumps sets of horizontal type for supplying drinking water/ potable water after filtration through dual media filter (DMF) & chlorination. This pump shall be installed near DMF plant. Drinking water/ potable water shall be stored in the over head potable water tank of 50 cum capacity.

2.02.04 AHP/ESP Wash

Two (2) – (1 working + 1 standby) 100% capacity service water pumps of vertical type to supply clarified water to AHP/ESP WASH region each of capacity 155 M3/hr.

2.02.05 DMF Feed pump

Three (3) nos. adequate capacity DMF feed pumps of vertical type to supply clarified water to dual media filter (DMF). For detail refer to Volume-IIIC, Section-1.

2.03.00 **Demineralised Water (DMW) Transportation System**

DM water from DM plant will be stored in the DM water storage tank located in the DM plant area. The DM Water Transportation System shall convey DM water from DM water Storage Tanks by means of two numbers (one working & one stand by) horizontal centrifugal type DM water Transfer Pumps to the Condensate Storage Tanks for meeting cycle make up and other requirements. DM water transfer pumps are placed in the vicinity of DM water storage tanks. Condensate storage tanks are located close to boiler area.

3.00.00 **CODES AND STANDARDS**

3.01.00 The design, manufacture and performance of the pumps as specified hereinafter, shall comply with the requirements of the following codes and standards and shall include all its latest amendments subsequent to the year of publication as mentioned below. In addition, to the following codes and standards, other applicable codes of practice as mentioned in Volume: IIA of this specification shall also be applicable.

3.01.01	IS-6595 Part-2	:	Horizontal Centrifugal pumps for clear, cold and fresh water (General purpose).
3.01.01	IS-1710	:	Vertical Turbine Pumps for Clear, Cold and Fresh Water.

- 3.01.02 IS-5120 : Technical requirements - Rotodynamic special purpose pumps.
- 3.01.03 IS-5639 : Pumps for handling chemicals and corrosive liquids.
- 3.01.04 IS-5659 : Pumps for process water.
- 3.01.05 IS-6536 : Pumps handling volatile liquids.
- 3.01.06 IS-9137 : Code for acceptance for centrifugal, mixed flow and axial flow pumps - Class 'C'.
- 3.01.07 BS EN ISO 9906 : 2000 : Acceptance tests for Centrifugal, mixed flow and axial flow pumps - Class 'C' Tests.
- 3.01.08 BS EN ISO 9906 : 2000 : Acceptance tests for Centrifugal, mixed flow and axial flow pumps - Class 'B' Tests.
- 3.01.09 ANSI B 73.2M : Vertical inline centrifugal pumps for chemical process.
- 3.01.10 API 610 : Centrifugal pumps for general refinery services.
- 3.01.11 Hydraulic Institute Standards of USA.
- 3.01.12 PTC 8.2 : Power Test Codes - Centrifugal pumps.
- 3.01.13 Other accepted International Standards such as DIN/JIS/GOST etc. which may be equivalent or superior to those specified above.
- 3.02.00 In case of any contradiction between the above standards and this section with its annexures, the stipulations in this section and annexures shall prevail and shall be binding to the Contractor.

4.00.00 **SCOPE OF SUPPLY**

The broad scope of supply in Plant water System shall be as below. Items not specifically mentioned but deemed necessary to make the systems and sub-systems completely reliable and efficient shall also be included. For detailed scope of supply, respective sections enclosed hereinafter shall be referred to.

4.01.00 **Raw Water Transportation System**

Raw Water Transportation system consist followings:

- a) Raw water pump house. Raw water pump house shall be made with balancing chamber.
- b) Three (3) vertical Raw water Pumps complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith.
- c) Isolation gates for pump house and isolation gates as required for

each pump sump.

- d) Fixed screens as required for each pump sump.
- e) Electric overhead traveling crane.

4.02.00 **Clarified Water Transportation System**

Clarified Water from Clarified water reservoir and from reservoir to various consumption points.

- a) Clarified water reservoir comprising of two (2) compartments. The reservoir shall be overground and covered type. Capacity of the reservoir shall be finalized by the Bidder.
- b) Clarified water pump house on the Clarified water reservoir.
- c) Two (2) vertical centrifugal type cooling tower make-up pumps complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith.
- d) Three (3) nos. adequate capacity DMF feed pumps of vertical type to supply clarified water to dual media filter (DMF). For detail refer to Volume-IIIC, Section-1.
- e) Two (2) vertical centrifugal type service water pumps complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith.
- f) Two (2) horizontal centrifugal type potable water pumps complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith.
- g) Two (2) vertical centrifugal type APH/ ESP pumps complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith.
- h) One (1) no. service water RCC over head tank of minimum capacity of 300 m³ and One (1) no. potable water tank of minimum capacity of 50 m³.
- i) Overhead traveling crane. Two (2) Under-slung type.

4.03.00 **Demineralised Water Transportation System**

- a) Two (2) nos. Demineralised water Storage Tanks of minimum capacity of 2000 m³ of each tank.
- b) Two (2) Horizontal centrifugal Pumps to supply DM water to Condensate storage tank.
- c) One (1) no. Condensate Storage Tank of min. capacity of 1000 m³.

d) Monorail and Hoist.

- 4.04.00 All interconnecting piping in plant water system and fabricated steel tanks complete with valves, fittings, instruments and all other accessories as represented in enclosed Flow diagrams and as per Section-IV and Section-V of Volume IIIE.
- 4.05.00 All electrical equipment and accessories as required for this system shall be supplied. These equipment and accessories shall meet the technical requirements of individual equipment specification covered under "Electrical Equipment & Accessories - Volume V" of this Bid Document.
- 4.06.00 For general guidelines regarding detailed scope of works and services Volume-II-A of this specification shall be referred to.
- 4.07.00 All instruments and central systems (Volume-VI) for efficient and reliable operation of the plant.
- 4.08.00 Any other Horizontal Centrifugal pumps complete with electric motor drives and all other accessories, if included by the Bidder within the scope of Plant Water System package.
- 4.09.00 Any other Vertical pumps complete with electric motor drives and all other accessories, if included by the Bidder within the scope of Plant Water System package.

5.00.00 **GENERAL DESIGN AND PERFORMANCE REQUIREMENTS**

- 5.01.00 All the Water Transportation Systems described shall be capable of conveying their rated capacities as per pipe sizing criteria specified in Annexure-I of this section.
- 5.02.00 Pipe sizes unless specified otherwise shall be selected by the Bidder based on optimization studies. The procedure and results of the optimization studies shall be furnished by the Bidder as part of his Bid proposal. However, for the purpose of such pipe sizing, recommended velocities at pump suction and discharge will be guided by the velocity chart in Annexure-I of this section.

Unless otherwise specified, manufacturer shall provide standard pipes in respect of size, in all services covered under this specification.

- 5.03.00 All piping and related accessories shall be designed to withstand a pressure not less than the shut off head of the respective system pumps.

Bidder shall also conduct water hammer analysis of the piping systems in different transient conditions such as closure of valves, tripping of pumps etc. Bidder shall also consider such transient pressure surges in designing of the piping systems. The procedure and results of water hammer analysis shall be furnished to purchaser for his information and approval.

- 5.04.00 CT make up water pipes shall be designed for maximum surface temperature of 50 Deg.C and minimum surface temperature of 3 Deg.C. These pipes shall be laid underground.

5.05.00 Following valves, fittings and appurtenances shall be provided by the Bidder as minimum requirement for each of the pumping systems, as applicable:

- a) Motorized discharge butterfly valves, quick closing power packed check valve, gate valves/check valves as required for respective pumps.
- b) Anti-vacuum Valve - This shall serve the function of air release and air inlet.
- c) Air Cushion Valve - These valves will admit air in the pipeline and prevent any partial vacuum near the pumps.
- d) Isolating butterfly valves shall be provided at suitable intervals and at suitable locations to isolate a particular section of pipeline for maintenance which will be mutually decided by Owner/Consultant and contractor during detail engineering stage.
- e) Scour or drain valves of suitable size at suitable locations for adequate drainage of pipelines.
- f) Thrust blocks and expansion joints/loops at suitable locations.
- g) Pipe supports/racks complete with all accessories, as specified.
- h) Any other accessories as required for safe and reliable operation of respective pumping system.

Bidder shall furnish a write up, adequately substantiating the use of the above appurtenances, as per applicability, in each water transportation system.

5.06.00 Butterfly valve design pressure and opening/closing time shall take into account all effects of water hammering and surge

5.07.00 The total dynamic head (TDH) of all pumps shall be obtained by conducting detailed system resistance calculations. Bidder shall furnish these calculations and system resistance curves superimposed on pump characteristic curves alongwith his Bid proposal. However, actual TDH shall be finalized by the bidder and following general guidelines shall be adhered to by the Bidder towards computation of same.

- a) Static head in each pumping system shall generally be obtained by considering the minimum suction level and maximum discharge point elevation. It shall also take into account all the highest levels encountered in the route.
- b) Frictional losses in pipes shall be calculated based on pumping capacity as specified in Annexure-II, assuming $C = 120$ on Hazen and Williams Formula for design purpose. A minimum of ten (10) percent margin shall be provided over and above the calculated frictional losses.

- 5.08.00 Pumps shall preferably be designed to have the best efficiency at the specified duty point. The pumps shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated in the annexure-II and annexure-III attached with this section.
- 5.09.00 Pumps shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation.
- Under all circumstances, the "range of operation" of the pumps shall exclude any unstable operating zone of the head - capacity curve.
- 5.10.00 Wherever specified in the annexure attached herewith pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pumps working in parallel with it trip.
- 5.11.00 The pump set along with the drive motor shall run smooth without undue noise and vibration. Acceptable peak to peak vibration limits shall be generally guided by the Hydraulic Institute Standards of USA.
- 5.12.00 Clarified water reservoir shall be overground and covered and shall consist of two (2) compartments. The reservoir shall have adequate capacity considering the following:
- i. Eight (8) hours clarified water requirement for complete plant, equipments and systems.
- 5.13.00 All pump houses accommodating vertical wet pit pumps shall be designed by the Bidder in accordance with the following layout criteria as generally specified below:
- a) The pump sumps in each respective pump house shall be designed in strict conformance to the recommendations of Hydraulic Institute (USA)/British Hydraulic Research Association/equivalent standards. Dimension of sump shall be substantiated by the Bidder in his Bid Proposal.
 - b) If there is an intake fore bay at the entry to any of the pump houses, the angle of inclination of the side walls of the fore bay with the direction of water flow shall not exceed twenty (20) degrees under any circumstances.
 - c) If not specified elsewhere in this specification, the minimum water level of a particular sump shall be guided by the minimum submergence required by the respective pumps. The highest water level in a sump shall be such as to ensure a minimum clearance of 300 mm below the lowest concreted portion of the floor in the pump house. Under all circumstances, the net positive suction head available shall be sufficiently greater than the net positive suction head required, by each pump.

- d) Adequate provision shall be made in each of the pump sumps so as to facilitate insertion of isolation gates as and when required. Gates shall be fabricated of mild steel, shall be of watertight type and shall preferably be of identical size/dimensions to facilitate interchangeability. Sump gates shall generally be accessible by the pump house overhead crane.
- e) The respective pump house shall also accommodate the following equipment/facilities, as applicable.
 - i. All auxiliary equipment related to pump sets such as discharge piping complete with valves and specialties, electric motor drives etc.
 - ii. Ventilation system for the entire pump house.
 - iii. Separate bays for unloading and maintenance.
 - iv. All necessary electrical equipment and accessories as required for this system.
 - v. Overhead Crane complete with all accessories, as specified in Volume-III F, Section-II of this specification.
 - vi. Sump pumps, as specified in Volume-III F, Section-I of this specification.
 - vii. Fixed Screens and accessories located suitably.
 - viii. Necessary toilets and operator's cabins with drinking water facility.
- f) Other general layout criteria as specified in Volume IIA of this specification shall also be adhered to while designing the pump house.

5.14.00 All Horizontal and Vertical Pumps of Plant Water System shall have 10% margin on capacity and 20% margin on Total Dynamic Head.

6.00.00 **DESIGN AND CONSTRUCTION**

6.01.00 **Horizontal Pumps**

6.01.01 **Pump Casing**

Pump casing shall be provided with adequate number of vents and priming connections with valves unless the pump is made self-venting and priming. Casing drain, as required, shall be provided complete with drain valves.

Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

In cases where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to

the foundation. This additional thrust shall be taken into consideration during pump design.

6.01.02 Impeller

The rotor assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.

6.01.03 Wearing Rings

Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing.

6.01.04 Shaft

Shaft size shall be selected considering that the critical speed shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall also be at least 10% away from runaway speed.

6.01.05 Shaft Sleeves

Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the other faces of gland packing or seal end plate so as to distinguish between the leakage past shaft and shaft sleeve and that past the seals/glands.

Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

6.01.06 Bearings

Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.

Heavy duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.

In case of sleeve type radial bearings, axial thrust shall be absorbed in suitable hydraulic devices and/or thrust bearings.

Bearings and hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.

6.01.07 The bearings shall be oil/grease lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete with all accessories like pump, filters, pipings, fittings, valves, interlocking and supervising instruments etc. as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.

6.01.08 **Stuffing Boxes**

Stuffing box design shall permit replacement of packing without removing any part other than the gland.

Stuffing boxes shall be sealed/cooled by the fluid being pumped. All necessary pumps, piping, fittings, valves, instruments etc. as required for safe and trouble-free operation of the pumps shall be included in the scope of supply.

6.01.09 **Mechanical Seals**

Mechanical seals shall be provided if specified in the Annexure attached with this section. The pump supplier shall co-ordinate with the seal maker in establishing the circulation rate for maintaining a stable film at the seal face in the chamber. The seal piping system shall form an integral part of the pump assembly.

For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure, even when the pumps are not operating.

6.01.10 **Drive Unit**

The pumps shall be driven by electric motor directly coupled. A heavy duty flexible coupling along with coupling guard shall be provided between the pump and drive unit. For details regarding specification of drive unit Volume-V of this specification will be referred.

Unless otherwise specified drive unit power rating shall be the maximum of the following requirements.

- a) 15% (for LT motor) or 10% (for HT motor) margin over the pump shaft input power at the rated duty point.
- b) 5% margin over the maximum pump shaft input power required within the "Range of Operation".
- c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.

6.02.00 **Vertical Pumps**

Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories, as applicable. General design and constructional features of the pumps shall be as follows:

6.02.01 **Bowl Assembly**

This will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of the handling fluid.

Pump(s) shall have provision for adjustment of impellers in vertical direction

from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.

6.02.02 Discharge Head

Pump(s) shall be either above floor or below floor discharge type, as specified in the annexure, attached to this section.

In case, expansion joint is to be used at the pump discharge, pump base plate shall either be adequately designed to take the unbalanced forces and moments from the use of such expansion joint or a separate thrust block at the pump discharge head shall be provided to transmit these forces to the external supporting structure. Calculation of thrust load shall be done considering the highest pressure seen by the pump and internal diameter of the arch of the expansion bellow.

6.02.03 Column pipe

Column pipe shall be flanged and of bolted connection. Column pipes shall be designed for full internal vacuum.

In case the annexure ask for the pump with below floor discharge, and the water level is at or above the discharge valve level, the column pipe piece located at the intermediate floor level shall be provided with suitable floor sealing device.

In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps, etc. necessary for such purpose shall be supplied by the Contractor under this section. The Contractor shall also submit a write-up describing clearly the procedure of handling the pump.

6.02.04 Impeller shaft, line shaft and head shaft

Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft.

Critical speed of the shaft shall be sufficiently away from the pump operating speed and in no case shall lie between 90% and 110% of the rated speed.

Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall be chamfered at the edges.

Line shaft may be of single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard practice of the manufacturer.

For screwed coupling, screw directions shall permit tightening of the joint during pump operation.

Replaceable shaft sleeves shall be furnished at applicable locations, particularly under stuffing box and at other locations, as considered necessary.

6.02.05 Shaft enclosing tube

Shaft enclosing tube shall be required, unless self lubricated (and cooled) type of shaft bearings are asked for. Length of the shaft enclosing tube shall be in conformity with the shaft piece lengths.

6.02.06 Seal rings

Replaceable seal/wear rings both on impeller and on casing shall be provided in case it is asked for in the annexure.

6.02.07 Bearings

a) Shaft bearings

Adequate number of properly designed bearings shall be provided for smooth and trouble-free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the Annexure.

In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. If the annexure calls for pre-lubrication of the shaft bearings, pre-lubrication tank and other accessories shall be within the scope of supply of the Bidder/ Contractor.

b) Thrust Bearing

Thrust bearing of adequate size and capacity shall be provided to take the vertical thrust of the impeller arising out of the pump operation and dead weight of the rotating components. Life of the thrust bearing shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.

Thrust bearings shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handling fluid. The arrangement shall also be adequate to protect the bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system.

Cooling of the thrust bearing if necessary, shall be done by the handling fluid/external water, depending on the fluid handled.

Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement of annexure or as per

the recommendation of the pump manufacturer (and approved by Purchaser).

6.02.08 Reverse Rotation

Following provision shall be provided to prevent damage due to reverse rotation of the pump motor assembly:

1. Non reversible ratchet mechanism
2. Necessary switch to detect reverse rotation will be provided to prevent motor switching 'ON' while rotating in reverse direction. Alarm will be provided in owners TFT based monitor.

6.02.09 Drive Unit

- a) The pump will be driven by electric motor.

A heavy duty coupling shall be provided between the drive unit and the driven equipment (except for belt drive).
- b) Unless otherwise specified in annexure, drive element power rating shall be the maximum of the following requirements.
 - i. 15% (for LT motor) or 10% (for HT motor) margin over the pump shaft input power at the rated working condition.
 - ii. 5% margin over the maximum pump shaft input power required within its operating range including the shut off point.
 - iii. Pump shaft input power required considering overloading of the pump assuming single pump operation in the event of tripping of the other pump(s) operating in parallel.
- c) The drive equipment shall preferably be air cooled. In case the pumping fluid is water, free of abrasive and corrosive matter, the same can be used for cooling purpose. The arrangement shall be within the scope of the equipment supplier.

6.03.00 For design and construction of piping, Section-IV and Section-V of Volume IIIE shall be referred to.

6.04.00 For design and construction of tanks, Section-IV of Volume IIIE of this volume shall be referred to.

6.05.00 For design and construction of reservoirs, Volume-VII shall be referred to.

7.00.00 **CONTROL & INSTRUMENTATION**

Complete instrumentation and control system including all accessories shall be provided for safe, reliable and trouble-free operation of the plant. For details Bidder shall refer to volume VI, Specification for Controls & Instrumentation.

8.00.00 **INSPECTION AND TESTING**

8.01.00 The Contractor shall carry out the following specific tests and inspections to ensure that the equipment furnished shall conform to the requirements of this section and in accordance with relevant codes and standards. Test certificates for all tests shall be submitted to the Owner for approval.

8.02.00 **Horizontal Pumps**

8.02.01 Material Identification and Testing

- i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standards. Components on which material test has been done shall be stamped for identification.
- ii) Tests for each pump included under this section shall also include but shall not be limited to the following:
 - The entire surface of the impeller castings shall be subjected to Dye Penetration Test as per ASTM Specification no.: E165-65.
 - Shaft shall be subjected to Dye Penetration and Ultrasonic Tests.
 - Wearing rings shall be subjected to Dye Penetration Test.
 - Verification of material, witnessing of pouring, casting and inspection of finalised fabricated/cast castings.
 - Inspection of finished castings for impeller and verification of materials.
 - Inspection of pump shaft and verification of material.
 - Witnessing of NDT/review of NDT reports.
 - Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940.
 - Complete inspection of assembled pump

8.02.02 Hydrostatic Testing

The pump casing and all other applicable pressure parts shall be hydrostatically tested at 150% of the pump shut-off pressure. Pressure shall be maintained for a period of not less than one (1) hour. While arriving at the

above values maximum suction pressure shall be taken into account.

8.02.03 **Dynamic Balancing**

All rotating components shall be statically and dynamically balanced. Dynamic balancing tests shall be carried out at a speed not less than the rated rpm of the pump. Test procedure and acceptance limits shall be guided by the relevant testing codes and standards.

8.02.04 **Performance Test at Shop**

- i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Purchaser's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS EN ISO 9906) or any other equivalent standard but the tolerances on head, discharge and power shall be as specified in HIS, USA. Prior to performance test, the pump supplier shall furnish the procedures and methods of testing to the Purchaser for approval.
- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 130% of rated capacity upto pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.
- iii) Tests shall be conducted at the rated rpm.

Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

8.03.00 **Vertical Pumps**

8.03.01 **Material Identification and Testing**

- i) Material identification and testing shall include, but shall not be limited to the following components :
 - Bowls and suction bells.
 - Impeller and wearing rings.
 - Shafts and shaft sleeves.
 - Couplings.
 - Bearings.
 - Column pipes.

- Discharge heads.
- Bowl Assembly.
- Any other components in the pump assembly.

ii) Tests shall also include but shall not be limited to the following:

- The entire surface of the impeller castings shall be subjected to Dye Penetration Test as per ASTM-E-165.
- Shaft shall be subject to Dye penetration and Ultrasonic test.
- Wearing rings shall be subjected to Dye Penetration Test.
- Witnessing of NDT/review of NDT reports.
- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO-1940.
- Complete inspection of assembled pump.

8.03.02 Dynamic Balancing

Rotating components of the pump shall be statically and dynamically balanced. Dynamic balancing tests shall be carried out for the impeller at a speed not less than the rated rpm of the pump. Test procedure and acceptance limits shall be guided by the relevant testing codes and standards.

8.03.03 Hydrostatic Testing

Hydrostatic test shall be done for the following components (as minimum) at 150% of shut-off pressure. Pressure shall be maintained for a period of not less than one (1) hour. While arriving at the above values, maximum suction pressure shall be taken into account.

- Bowls/Suction bells.
- Column pipe.
- Discharge head.
- Any other applicable pressure parts.

8.03.04 Performance Test at Shop

- i) Each pump shall have to be tested to determine its performance curves. These tests are to be conducted in presence of Purchaser's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard but the tolerances on head, discharge and power shall be as specified in HIS, USA.

- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps. These shall be carried out to span 130% of rated capacity upto pump shut-off condition. A minimum of five (5) combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation specified. After completion of performance test, all pumps shall be stripped down for inspection of internals.
- iii) Tests shall be conducted at the rated rpm.
- iv) The Bidder shall submit in his proposal the facilities available at his works to conduct performance testing.
- v) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.
- vi) Reports and test certificates of above tests shall be submitted to the Purchaser for approval.

9.00.00 **DRAWINGS, DATA, CURVES AND INFORMATION**

The Bidder shall submit the following along with his formal proposal besides the different information plate required as indicated elsewhere in this specification

- 9.01.00 Piping and instrumentation diagram of Plant water system.
- 9.02.00 General arrangement drawing of Jackwell pump house, raw water transfer pump house, clarified water pump house.
- 9.03.00 General arrangement of clarified water reservoir.
- 9.04.00 General Arrangement drawing of service water, potable water tank, DM water storage tank and condensate storage tank.
- 9.05.00 **Horizontal Pumps**
- 9.05.01 Drawings
 - a) General arrangement and outline drawings showing the principal dimensions, weight and location of the suction and discharge connections of the pumps offered. Details of lubrication and sealing arrangement shall also be included.
 - b) Typical cross-section drawing showing various components of the pumps offered, materials of construction etc.
- 9.05.02 Data and Curves

- a) Determination of pump total dynamic head at rated capacity as per guidelines specified in Section-I of this Volume. Detailed calculations for computing static head and frictional losses shall be furnished by the Bidder.
- b) Anticipated performance curves showing the following characteristics:
 - i. Capacity vs. head
 - ii. Capacity vs. power
 - iii. Capacity vs. efficiency
 - iv. System resistance curves
- c) Speed vs. torque curve of the pump corresponding to recommended mode of pump starting superimposed on speed vs. torque curves of the drive unit corresponding to 80%, 90%, 100% of the rated voltage (applicable only in the cases of pumps with drive motor power rating of 100 KW and above).
- d) Completely filled-in Technical Proposal Particulars enclosed under Volume-IX of this specification.
- e) Details of manufacturing and testing facilities in pump manufacturer's works and illustrative literature regarding the pumps offered.

9.06.00 Vertical Pumps

9.06.01 Drawings/Data

- a) Determination of respective pump total dynamic head and capacity as per guidelines of this specification. Detailed calculations for obtaining static head and frictional losses shall be submitted by the Bidder.
- b) Outline drawings of the pump showing the various dimensions, suction and discharge locations.
- c) Typical cross sectional drawing of the pump to be supplied, showing various components, bearings, seal rings etc. and materials of construction for all items.
- d) Lubrication arrangement drawings for external lubrication.

9.06.02 Anticipated performance curves and test curves for:

- a) Capacity Vs Head.
- b) Capacity Vs. Power & Capacity Vs. Efficiency.
- c) System resistance curves.
- d) Speed Vs. torque requirement of the pump (for pump sets with drive motor rating of 100 KW or more) together the drive motor speed-torque characteristic.

- 9.07.00 Completely filled up schedules enclosed under Volume-IX of this specification.
- 9.08.00 Descriptive and illustrative literature regarding the pumps offered.
- 9.09.00 A comprehensive write-up or brochure regarding the details of manufacturing and testing facilities in the shop of the manufacturer.
- 9.10.00 A write-up describing clearly the procedure for installing the pump with its column pipe - piece by piece and also for overhauling the pump in a like manner. A diagram showing the required pump house crane hook lift above the pump operating floor has also to be furnished.
- 9.11.00 The successful Bidder shall furnish the following drawings/data/ manuals for Purchaser/Engineer's approval after award of the contract.
 - 9.11.01 Final versions of all the drawings, documents as specified in the clauses above.
 - 9.11.02 Principal dimensions of the pump sump indicating clearance dimensions for the suction bell from back wall and side walls, minimum submergence required for the pump etc.
 - 9.11.03 Pump foundation details along with all design loads with static and dynamic loads, direction and points of application.
 - 9.11.04 Pump and drive sealing, bearing lubrication and cooling arrangement drawing.
 - 9.11.05 Drive data.
 - 9.11.06 Test reports, test certificates, performance curves and other particulars.
 - 9.11.07 Instruction Manuals.
 - 9.11.08 Any other applicable drawings and documents as specified in Volume-IIA of this specification.

ANNEXURE-I**RECOMMENDED VELOCITY CHART FOR PIPE SIZING**

Sl. No.	Description of pipe	Velocity (M/Sec.) Pipe size Below 50 mm	Velocity (M/Sec.) Pipe size 50-150 mm	Velocity (M/Sec.) Pipe size 200 mm & above
1.	Pipeline at pump suction for water	-	1.2 – 1.5	1.2 – 1.8
2.	Pipeline at pump discharge for water	1.2 - 1.8	1.8 –2.4	2.1 – 2.5
3.	Header for water	--	1.5 – 2.4	1.8 - 2.4
4.	Instrument air below 2 Kg/Sq.cm (g)	15 - 20	20 - 30	25 - 35
5.	Instrument air at 2 Kg/Sq.cm (g) & above	20 - 30	25 – 40	35 - 45

ANNEXURE-II

HORIZONTAL CENTRIFUGAL PUMPS (PART-1)

Sl. No.	Description	DM Transfer Pumps	Drinking/ potable water Pumps
1.	Service	DM Transfer	Drinking/ potable water
2.	Designation	DM Transfer Pump	Drinking/ potable water Pumps
3.	Duty	Continuous	Intermittent
4.	Location	Outdoor	Indoor
5.	Number of Pumps required	Two (2)	Two (2)
6.	Number of pumps working	One (1)	One (1)
7.	Number of pumps standby	One (1)	One (1)
8.	Number of pumps working in parallel	NA	NA
9.	Liquid handled	DM Water	Clarified Water
		<----- (For analysis refer Vol.IIA, Section-IX of this specification) ----->	
10.	Design Temperature	50°C	50°C
11.	Suction Lift/ Head available (MLC)	Flooded suction shall be ensured	Flooded suction shall be ensured

Sl. No.	Description	DM Transfer Pumps	Drinking/ potable water Pumps
12.	Pump Performance Requirements		
a)	Rated Capacity (Cu.m/hr)	By Bidder	By Bidder
b)	Total Dynamic Head as per IS-5120 at Rated Capacity (MLC)	By Bidder	By Bidder
c)	Rated Speed (rpm) Max	1500	1500
d)	Noise Level	85 dBA	85 dBA
e)	Permissible Tolerance in Rated Capacity (%)	As per IS:6595	
f)	Permissible Tolerance in Efficiency at Rated Capacity (%)	<----- No Negative tolerance ----->	
g)	Range of Operations	<-----Bidder to indicate, preferably between 75% to 130% of rated capacity----->	
13.	Design Standard	<----- Hydraulic Institute Standard /IS-5120/ Equivalent Standard ----->	
14.	Impeller Type	Closed	Closed
15.	Type of Gland Lubrication and Sealing	Self-water	Self-water

Sl. No.	Description	DM Transfer Pumps	Drinking/ potable water Pumps
16.	Shaft Sealing Arrangement	<----- Mechanical Seal ----->	<----- Mechanical Seal ----->
17.	Type of Pump-motor Connection	Direct	Direct
18.	Type of Coupling	Flexible	Flexible
19.	Mode of Pump Starting	<----- Discharge Valve Fully Closed ----->	<----- Discharge Valve Fully Closed ----->
20.	Material of Construction		
a)	Casing	ASTM-A743 Gr. CF8M	IS 210 FG 260
b)	Casing Liner	<----- ASTM-A743 Gr. CF8M ----->	<----- ASTM-A743 Gr. CF8M ----->
c)	Diffuser	<----- ASTM-A743 Gr. CF8M ----->	<----- ASTM-A743 Gr. CF8M ----->
d)	Impeller	<----- ASTM-A743 Gr. CF8M ----->	<----- ASTM-A743 Gr. CF8M ----->
e)	Wearing Rings	<----- ASTM-A743 Gr. C440 ----->	<----- ASTM-A743 Gr. C440 ----->
f)	Shaft	<----- ASTM-A276 Gr.410 ----->	<----- ASTM-A276 Gr.410 ----->
g)	Shaft Seal	<----- ASTM-A276 Gr.316 ----->	<----- ASTM-A276 Gr.316 ----->
h)	Mechanical Seal	<----- Manufacturer's Standard ----->	<----- Manufacturer's Standard ----->
i)	Base Plate	<----- IS 2062 ----->	<----- IS 2062 ----->

Sl. No.	Description	DM Transfer Pumps	Drinking/ potable water Pumps
j)	Wetted Fastener	Stainless Steel AISI-304	Stainless Steel AISI-304
21.	Supply of Accessories & Services		
a)	Base Plate	Yes	Yes
b)	Foundation Bolts, Nuts, Sleeves etc.	Yes	Yes
c)	Suction and Discharge Companion Flanges with Bolts, Nuts and Gaskets	Yes	Yes
d)	Gland Sealing and Cooling Arrangement	Yes	Yes
e)	Bearing Lubrication and Cooling Arrangement	Yes	Yes
f)	Suction and discharge pressure Indicator	Yes	Yes
g)	Priming Connection with 3-way SS Isolating Valve	Yes	Yes
h)	Pump-motor Coupling Guard	Yes	Yes
i)	Vent with 3-way SS Isolating Valve	Yes	Yes

Sl. No.	Description	DM Transfer Pumps	Drinking/ potable water Pumps
j)	Drain Connection with Valve	Yes	Yes
k)	Eye-bolts, Lifting Tackle etc.	Yes	Yes
22.	Inspection and Testing	<----- As per clause no. 8.00.00 of this section ----->	

ANNEXURE-III**VERTICAL CENTRIFUGAL PUMPS (PART-1)**

SI No	Description	Raw Water Pumps
1.	Service	Raw Water supply
2.	Designation	Raw water Pumps
3.	Duty	Continuous
4.	Location	Indoor
5.	No. of Pumps required	3x50%
6.	No. of Pumps working	Two (2)
7.	No. of Pumps standby	One (1)
8.	No. of Pumps working parallel	Two (2)
9.	Liquid handled	Raw water For analysis refer Vol.IIA, Section-IX of this specification
10.	Temperature	50°C (design)
11.	Motor pedestal floor elevation	Bidder to indicate
12.	Level of bottom of sump	Bidder to indicate
13.	Normal water level (M)	Bidder to indicate
14.	Minimum water level (M)	Do
15.	Maximum water level M)	Do
16.	Pump performance requirement	
	a) Performance standard	IS-1710
	b) Rated capacity (Cu.M/Hr.)	Bidder to indicate
	c) Total dynamic head at rated capacity (MLC)	Bidder to indicate
	d) Static head of pumping system (MLC)	Do
	e) Pump shut off head (MLC)	Do

SI No	Description	Raw Water Pumps
17.	f) Permissible tolerance in rated capacity (%)	± 2.5 percent at rated head
	g) Permissible tolerance in efficiency at rated capacity	No negative tolerance
	h) Range of operation	Bidder to indicate preferably between 75% to 130% of rated capacity
	i) Suction specific speed	Shall be limited to 9000 US units
	j) Noise level	85 dBA (max)
	Design and constructional features	
	a) Design Standard	IS-1710/ Equivalent standard
	b) Pump type	Vertical Wet Pit Type Pump
	c) Impeller type	Closed
	d) Reverse flow through pump to be considered for pump design	Yes
	e) Head at reverse flow	Bidder to indicate
	f) Type of gland lubrication and sealing	By self water
	g) Location of thrust bearing	Separate for pump and motor
	h) Thrust bearing to be designed for pump shut off operation	Yes
	i) Type of coupling	Flexible
	j) Gland lubrication and sealing	By Self water
	k) Bearing cooling	By Self water
18.	Material of construction	
	a) Casing	2% Ni-C.I.
	b) Column pipe	IS-2062 (MS) (Min. 10 mm thick)
	c) Discharge elbow	IS-2062 (MS) (Min. 10 mm thick)
	d) Impeller	ASTM-A-351 Gr.CF8M

SI No	Description	Raw Water Pumps
	e) Shaft sleeve	AISI-410 (Hardened)
	f) Shaft bearing	Cutless Rubber
	g) Base plate	IS-2062
	h) Stuffing box	C.I.
	i) Line shaft	AISI-410
	j) Impeller shaft	AISI-410
	k) Shaft coupling	AISI-410 (Hardened)
	l) Fasteners	SS-316
	m) Companion flange	IS-2062
19.	Supply of accessories and services	
	a) Sole plate	YES
	b) Foundations bolts, nuts, sleeves etc.	YES
	c) Discharge flanges with nuts, bolts and gaskets	YES
	d) Gland sealing/ cooling and bearing cooling/ lubrication system complete with pipes, valves, fittings and instruments as required	YES
	e) Suction strainers	NO
	f) Pre-lubrication tank and accessories	NO
	g) Thrust block	Yes, if applicable
	h) Pump motor coupling and guard	YES
	i) Eye bolts, lifting tackle etc.	YES
	j) Discharge pressure gauge with isolating cock	YES
	k) Instrument connections	YES
	l) Vent with isolating cock	YES

SI No	Description	Raw Water Pumps
20.	m) All other accessories & services	YES
	Inspection and Testing	
	a) Material testing of casing, impeller and shafts	YES
	b) Hydrostatic testing	YES
	c) Dynamic balancing test	Required
	d) Sump model test at shop	Required
	e) Tests on casing/shaft	Yes, Radiography/ UT Test for above 50 mm dia. DP test/ MPI for below 50 mm dia.
	f) Test on impeller	Dye penetration Test
	g) Vibration and noise measurement	YES
	h) Performance Tests	YES
	i) Performance test to be done on	Proto type at full speed
	j) Performance test required for determining	Head Vs. capacity, BHP Vs. capacity, Efficiency Vs. capacity, submergence Vs. capacity curves
	k) Field performance test required	YES
	l) Other tests as per applicable clauses of this specification	YES

VERTICAL CENTRIFUGAL PUMPS (PART-2)

Sl No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
1.	Service	Cooling Tower make-up	Service water	APH/ESP Wash	
2.	Designation	CT Make-up Pump	Service Water Pump	APH/ESP Wash Pump	
3.	Duty	Continuous	Intermittent	Intermittent	
4.	Location	Indoor	Indoor	Indoor	
5.	No. of Pumps required	Two (2)	Two (2)	Two (2)	
6.	No. of Pumps working	One (1)	One (1)	One (1)	
7.	No. of Pumps standby	One (1)	One (1)	One (1)	
8.	No. of Pumps working parallel	NA	NA	NA	
9.	Liquid handled	Clarified Water	Clarified Water	Clarified Water	
		(For analysis refer Vol.IIA, Section-IX of this specification) ----->			
10.	Temperature	50°C	50°C	50°C	
11.	Motor pedestal floor elevation	Bidder to indicate	Bidder to indicate	Bidder to indicate	
12.	Level of bottom of sump	Bidder to indicate	Bidder to indicate	Bidder to indicate	
13.	Normal water level (M)	Bidder to indicate	Bidder to indicate	Bidder to indicate	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
14.	Minimum water level (M)	Do	Do	Do	
15.	Maximum water level (M)	Do	Do	Do	
16.	Pump performance requirement				
	a) Performance standard	IS-1710	IS-1710	IS-1710	
	b) Rated capacity (Cu.M/Hr.)	Bidder to indicate	Bidder to indicate	Bidder to indicate	
	c) Total dynamic head at rated capacity (MLC)	Bidder to indicate	Bidder to indicate	Bidder to indicate	
	d) Static head of pumping system (MLC)	Do	Do	Do	
	e) Pump shut off head (MLC)	Do	Do	Do	
	f) Permissible tolerance in rated capacity (%)	± 2.5 percent at rated head	± 2.5 percent at rated head	± 2.5 percent at rated head	
	g) Permissible tolerance in efficiency at rated capacity	No negative tolerance	No negative tolerance	No negative tolerance	
	h) Range of operation	Bidder to indicate preferably between 75% to 130% of rated capacity	Bidder to indicate preferably between 75% to 130% of rated capacity	Bidder to indicate preferably between 75% to 130% of rated capacity	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
17.	i) Suction specific speed	Shall be limited to 9000 US units	Shall be limited to 9000 US units	Shall be limited to 9000 US units	
	j) Noise level	85 dBA (max)	85 dBA (max)	85 dBA (max)	
	Design and constructional features				
	a) Design Standard	IS-1710/ Equivalent standard	IS-1710/ Equivalent standard	IS-1710/ Equivalent standard	
	b) Pump type	Vertical Wet Pit Type Pump	Vertical Wet Pit Type Pump	Vertical Wet Pit Type Pump	
	c) Impeller type	Closed	Closed	Closed	
	d) Reverse flow through pump to be considered for pump design	Yes	Yes	Yes	
	e) Head at reverse flow	Bidder to indicate	Bidder to indicate	Bidder to indicate	
	f) Type of gland lubrication and sealing	By self water	By self water	By self water	
	g) Location of thrust bearing	Separate for pump and motor	Separate for pump and motor	Separate for pump and motor	
	h) Thrust bearing to be designed for pump shut off operation	Yes	Yes	Yes	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
18.	i) Type of coupling	Flexible	Flexible	Flexible	
	j) Gland lubrication and sealing	By Self water	By Self water	By Self water	
	k) Bearing cooling	By Self water	By Self water	By Self water	
	Material of construction				
	a) Casing	2% Ni-C.I.	2% Ni-C.I.	2% Ni-C.I.	
	b) Column pipe	IS-2062 (MS) (Min. 10 mm thick)	IS-2062 (MS) (Min. 10 mm thick)	IS-2062 (MS) (Min. 10 mm thick)	
	c) Discharge elbow	IS-2062 (MS) (Min. 10 mm thick)	IS-2062 (MS) (Min. 10 mm thick)	IS-2062 (MS) (Min. 10 mm thick)	
	d) Impeller	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	
	e) Shaft sleeve	AISI-410 (Hardened)	AISI-410 (Hardened)	AISI-410 (Hardened)	
	f) Shaft bearing	Cutless Rubber	Cutless Rubber	Cutless Rubber	
	g) Base plate	IS-2062	IS-2062	IS-2062	
	h) Stuffing box	2% Ni-C.I.	2% Ni-C.I.	2% Ni-C.I.	
	i) Line shaft	AISI-410	AISI-410	AISI-410	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
19.	j) Impeller shaft	AISI-410	AISI-410	AISI-410	
	k) Shaft coupling	AISI-410 (Hardened)	AISI-410 (Hardened)	AISI-410 (Hardened)	
	l) Fasteners	SS-316	SS-316	SS-316	
	m) Companion flange	IS-2062	IS-2062	IS-2062	
	Supply of accessories and services				
	a) Sole plate	YES	YES	YES	
	b) Foundations bolts, nuts, sleeves etc.	YES	YES	YES	
	c) Discharge flanges with nuts, bolts and gaskets	YES	YES	YES	
	d) Gland sealing/ cooling and bearing cooling/ lubrication system complete with pipes, valves, fittings and instruments as required	YES	YES	YES	
	e) Suction strainers	NO	NO	NO	
	f) Pre-lubrication tank and accessories	NO	NO	NO	
	g) Thrust block	Yes, if applicable	Yes, if applicable	Yes, if applicable	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
20.	h) Pump motor coupling and guard	YES	YES	YES	
	i) Eye bolts, lifting tackle etc.	YES	YES	YES	
	j) Discharge pressure gauge with isolating cock	YES	YES	YES	
	k) Instrument connections	YES	YES	YES	
	l) Vent with isolating cock	YES	YES	YES	
	m) All other accessories & services	YES	YES	YES	
	Inspection and Testing				
	a) Material testing of casing, impeller and shafts	YES	YES	YES	
	b) Hydrostatic testing	YES	YES	YES	
	c) Dynamic balancing test	Required	Required	Required	
	d) Sump model test at shop	Required	Required	Required	

SI No	Description	CT Make-up Pumps	Service Water Pumps	APH/ESP Wash Pump	
e)	Tests on casing/shaft	Yes, Radiography/ UT Test for above 50 mm dia. DP test/ MPI for below 50 mm dia.	Yes, Radiography/ UT Test for above 50 mm dia. DP test/ MPI for below 50 mm dia.	Yes, Radiography/ UT Test for above 50 mm dia. DP test/ MPI for below 50 mm dia.	
f)	Test on impeller	Dye penetration Test	Dye penetration Test	Dye penetration Test	
g)	Vibration and noise measurement	YES	YES	YES	
h)	Performance Tests	YES	YES	YES	
i)	Performance test to be done on	Proto type at full speed	Proto type at full speed	Proto type at full speed	
j)	Performance test required for determining	Head Vs. capacity, BHP Vs. capacity, Efficiency Vs. capacity, submergence capacity curves	Head Vs. capacity, BHP Vs. capacity, Efficiency Vs. capacity, submergence capacity curves	Head Vs. capacity, BHP Vs. capacity, Efficiency Vs. capacity, submergence capacity curves	
k)	Field performance test required	YES	YES	YES	
l)	Other tests as per applicable clauses of this specification	YES	YES	YES	

VOLUME : IIA

SECTION-VIII GENERAL TECHNICAL REQUIREMENT FOR REQUIREMENTS OF SPARES, TOOLS & TACKLE, LUBRICANTS/OIL/CONSUMABLES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	TOOLS AND TACKLE
2.00.00	SPARES
	ATTACHMENT
ANNEXURE-I	MANDATORY SPARE LIST

VOLUME : IIA

SECTION-VIII

**REQUIREMENTS OF SPARES, TOOLS & TACKLE,
LUBRICANTS/OIL/CONSUMABLES**

1.00.00 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackle as required for the erection, assembly, dismantling & maintenance of the equipment. These special tools will also include special material handling equipment, jigs & fixtures for maintenance and calibration/readjustment, checking & measurement aids etc. A list of such tools & tackle shall be submitted by the Bidder along with the offer. Detailed description of each tools/tackle, its function along with the equipment/part for which it is meant for and the price of each tools/tackle shall also be indicated in the offer. These tools & tackle shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

2.00.00 SPARES

2.01.00 General

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

2.01.02 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.

- 2.01.05 The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Purchaser for 30 years after commissioning of the plant.
- 2.01.06 Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is earlier. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.
- 2.02.00 **Recommended Spares**
- 2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.
- 2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalised after mutual discussion.
- 2.03.00 **Start-up Commissioning Spares**
- 2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.
- 2.03.02 The Contractor shall submit a complete BBU list inclusive of recommended, mandatory, initial start-up and commissioning spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.
- 2.04.00 **Mandatory Spare Parts**
- 2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.

Since the components involved can not be foreseen at the bidding stage, only

broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of this guideline, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

2.04.02 The mandatory spares should be supplied to the Owner at least one month before the trial run. The despatch programme is subject to approval of the Owner/Consultant after award of contract.

2.04.03.1 Criteria for selection of Quantity of Mandatory Spares :

For Mandatory Spares refer Annexure-I.

2.04.04 Purchaser will have the option to procure any or all of the mandatory spares at his discretion.

VOLUME : X

SECTION - I

**GENERAL TECHNICAL REQUIREMENT FOR
PERFORMANCE GUARANTEES**

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	PERFORMANCE GUARANTEES, PERFORMANCE/ ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE
2.00.00	START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS
3.00.00	SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]
4.00.00	SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES [CATEGORY-B]

VOLUME : X

SECTION-I

PERFORMANCE GUARANTEES

1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

- a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.
- b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

- i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

OR

- ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

- i) Mechanical Completion
- ii) Preliminary Operation
- iii) Initial Operation
- iv) Reliability Operation
- v) Trial Operation
- vi) Performance Guarantee Tests

2.01.00 **Mechanical Completion**

- (a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the

works.

- (b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:
 - (i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.
 - (ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and
 - (iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00

Specific Requirements of Mechanical Completion

- (a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:
 - (i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.
 - (ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.
- (b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:

- (i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.
- (ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.
- (iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.
- (iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.
- (v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.
- (vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.
- (vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.
- (viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

2.03.00

Other Prerequisites for Mechanical Completion

The Contractor shall also meet the following prerequisites for mechanical completion:

- (a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.
- (b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.
- (c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

- (d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.
- (e) All safety features and safety equipment are functional.
- (f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.
- (g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

2.04.00 Preliminary Operation

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

2.05.00 Initial Operation

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

2.06.00 Reliability Operation

- (a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

- (b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.
- (c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.
- (d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

- (e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.
- (f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.

- (g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.
- (h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

2.07.00

TRIAL OPERATION:

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.
2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.
3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.
5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.
6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

2.08.00

Performance Tests

- (a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trial operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

- (b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

- (c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/'equipment' with the performance

guarantees.

- (d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.
- (e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.
- (f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.
- (g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.
- (h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.
- (i) It is Contractor's responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor's offer shall also be conducted.
- (j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.
- (k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.
- (l) **Reporting of Test Results**
 - (a) Within two weeks after the conclusion of the performance test,

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

- (b) The report(s) shall include as a minimum, the following:-
 - (i) Scope
 - (ii) Various guaranteed parameters & tests as per the contract.
 - (iii) Codes/standards used
 - (iv) . Description of the test procedures
 - (v) Full schematic diagrams with indication of test instruments locations and identification tags of same.
 - (vi) Instrumentation details and calibration.
 - (vii) Duration of test, frequency of readings and number of test runs
 - (viii) Test logs and summary of test readings used for performance calculations.
 - (ix) Full set of correction curves.
 - (x) Computation of test results.
 - (xi) Sample calculation
 - (xii) Performance calculation
 - (xiii) Computations to prove measurement uncertainty is within acceptable limits.
 - (xiv) Acceptance criteria
 - (xv) Any other information required for conducting the test
 - (xvi) Conclusions of performance tests.
- (m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-
 - (i) That Purchaser concurs with the information provided in the test report(s), or
 - (ii) That Purchaser disputes some or all of the information provided

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

- (n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.
- (o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

2.09.00 **Delayed Tests**

- (a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.
- (b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

(c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

(d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.

(e) Disagreement as a Result of Tests

If the Purchaser and the Contractor disagree on the interpretation of the test results, each shall give a statement of his views to other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

3.00.00

**SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES
[CATEGORY-A]**

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.00	Plant		
3.01.01	Efficiency of steam generator	Efficiency of the steam generator at 100% & 80% TMCR while firing the Design coal at rated steam parameters, rated coal fineness and rated excess air. (Refer Note-1 for estimation of weightage factor.) Design coal shall be blended coal (50% imported coal + 50% indigenous coal).	As per Volume-I.
3.01.02	Steam generating capacity	Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.	As per Volume-I.
3.01.03	Turbine Cycle Heat rate	Turbine Cycle Heat rate in kcal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% & 80% of rated load (Refer Note-1 for estimation of weightage factor.)	As per Volume-I.
3.01.04	Output	Continuous output (MW) of 100% TMCR at Generator terminals under rated steam conditions at Turbine Inlet (247 kg/cm ² (a), 565°C, 593°C) and CW temperature of 33°C with 0% make-up with excitation power deducted	As per Volume-I.
3.01.05	Condenser Pressure	Condenser pressure in mm Hg (abs) under VVO conditions, 3% make up, design CW temperature and CW flow.	As per Volume-I.

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.06	Total Auxiliary Power Consumption	The total auxiliary power consumption for all the auxiliaries of boiler, turbine Generator and turbine cycle equipments required for continuous unit operation at 100% and 80% of rated load under rated steam conditions and at design condenser pressure with 0% make-up. (Refer Note 1, 2, 3 & 4 for the basis of computation of Auxiliary power)	As per Volume-I.
3.01.07	Cooling Tower Cold Water Temperature	Cooling tower cold water at 100% TMCR under rated steam conditions and at design condenser pressure.	As per Volume-I.

Note :

- The weightage factor shall be estimated considering the following:
 - 80% rating for 2000 hrs in a year,
 - 100% rating for 6300 hrs in a year.
- For computation of Auxiliary Power, output measured at Generator terminals minus sent out power measured downstream of Generator Transformer, applicable Losses (No load loss + Load loss+ auxiliary loss for coolers) for Standby Transformers, Unit Transformers and Bus duct losses shall be considered.
- The equipment for auxiliary power consumption to be considered by the bidder shall include the equipment as per Annexure-C of Volume-I as minimum.
- Power consumption for Fire Pumps, Sump Pumps, Elevators, EOT Cranes shall not be considered in the Auxiliary Power consumption estimate.
- Heat Rate of TG Cycle : Maximum 1850 Kcal/kwh with Steam Turbine driven BFP.
- Steam Generator Efficiency : Not less than 85%
- Auxiliary Power Consumption shall be limited to 6% with Steam Turbine driven BFP and NDCT.
- Normal Availability of the Plant : 98% (2% forced outage)
- Plant Reliability : Minimum 95%
- The condenser pressure measurement while conducting the guarantee tests for CI Nos 3.01.03, 3.01.04 and 3.01.05 above shall be measured at 300 mm above the top row of condenser tubes.

4.00.00 SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:

4.01.00 Steam Generator

4.01.01 Capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working as per Owner's discretion) and the coal being fired within range specified, corresponding to 100% BMCR at 33°C CW temperature.

4.01.02 Efficiency in percentage at 100% & 80% TMCR and 27°C ambient air temperature and 60% RH with zero make-up, condenser vacuum of 77 mm Hg(a) or better while firing the Design coal at rated steam parameters at Superheater and Reheater outlet and rated excess air and with any combination of mills working as per Owner's discretion. Design coal shall be blended coal (50% imported coal + 50% indigenous coal).

4.01.03 Air heater air-in-leakage after 3000 hrs. of operation from taking over date. To be demonstrated.

4.01.04 NOx emission

NOx emission from the unit – shall not be more than 365 ppm or 750 mg/Nm³ (equivalent NO₂) at the ESP outlet at 6% excess oxygen.

4.01.05 Mill capacity at rated fineness.

4.01.06 Gas tightness efficiency of Guillotine dampers.

4.01.07 No fuel oil support shall be required above 30% of BMCR.

4.01.08 Performance characteristics of pumps, fans, etc. viz; capacity, head developed etc.

4.01.09 Capabilities of all drives.

4.01.10 Margins on fans. Through operation of single fan at a time.

4.01.11 Equal load sharing of pumps/fans while running in parallel shall be demonstrated.

4.01.12 Run back capabilities.

4.01.13 Ramp/sudden load change withstand capability.

4.01.14 Life of mill wear parts

4.01.15 Furnace Exit Gas Temperature

The Bidder shall demonstrate by direct measurements that the Furnace Exit Gas Temperature (FEGT) at the specified location does not exceed the

specified maximum temperature of BMCR. The test equipment to be used for this demonstration shall be latest, state of the art, to the approval of Owner.

4.01.16 Flue Gas Temperature

The Bidder shall also demonstrate that the flue gas temperature at the entry and exit of various boiler heating surfaces and also the variation across the cross section perpendicular to gas flow do not exceed the values considered for the pressure parts design.

4.01.17 Steam Temperature Imbalance

The Bidder shall guarantee and demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10°C.

4.01.18 SH/RH Attenuation System

The Bidder shall guarantee and demonstrate that the spray water flow to SH attenuation system does not exceed the value considered for design (to be indicated in the bid) while maintaining the rated SH outlet steam temperature at BMCR. The Bidder shall also guarantee and demonstrate that the RH temperature is maintained at the rated value without any spray water requirement, for the secondary attenuation system, at all loads for which the specified RH steam temperature is required to be maintained at the rated value.

4.02.00 **Electrostatic Precipitator**

4.02.01 Pressure drop across the electrostatic precipitator.

4.02.02 Collection efficiency and outlet dust concentration shall be as per cl. no. 3.01.00 of Section-II in Volume-II-B.

4.03.00 **Turbine Generator**

4.03.01 Turbine Generator-Set Capability

The steam turbine generator unit shall be capable of delivering continuously at generator terminals the output as indicated by the Bidder in the following heat balances detailed out elsewhere with equipment specification submitted alongwith the bid.

- a) Output corresponding to top HP heaters out of operation.
- b) Output corresponding to all HP heaters out of operation.
- c) Output corresponding to VVO flow, at rated steam conditions with condenser CW temperature 33°C & condenser of vacuum 77 mm HgA or better with 0% make-up.
- d) Output corresponding to overpressure operation of the boiler-turbine-generator set, at rated main steam and hot reheat steam

temperature with condenser CW temperature corresponding to Condenser vacuum of 77 mm HgA or better with zero percent make-up.

4.03.02 Operating Frequency Range

As per the stipulations of Cl. No. 7.06.00 Vol. II-C, Section-I.

4.03.03 Constant Pressure and Sliding Pressure Operation

The constant pressure operation and sliding pressure operation from 30% turbine MCR to VWO condition of the unit in conjunction with the steam generator, HP-LP bypass system and instrumentation & control system shall be demonstrated.

In sliding pressure mode of operation, during quick load increase the idle control valve (s) must respond rapidly to pick up 20% of operating load, so that immediate increase of boiler pressure is not required. The load response capability shall be demonstrated in steps of 5 %.

Change-over from constant pressure mode to sliding pressure mode and vice-versa shall also be demonstrated.

4.03.04 Start-up, Loading, Unloading and Shutdown Capabilities

Start-up, loading, unloading and shutdown characteristics and startup time and loading capabilities for the steam turbine generator and steam generator both operating as a unit for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) under constant pressure and variable pressure mode and suitability for cyclic operation as indicated by the Bidder in the offer and accepted by the Owner shall be demonstrated ensuring the parameters of vibration, differential expansion, etc.

4.03.05 Vacuum Pulling time

Vacuum pulling time from condenser at atmospheric pressure to rated vacuum compatible to start Steam Turbine

4.03.06 Sudden Total Loss of External Load

On occasions, the steam turbine generator system may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip on overspeed but shall continue in operation under the control of its speed governor to supply power for the plant auxiliary load station transformers, while staying within the prescribed permissible limits of steam metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity acceptable to the Owner.

4.03.07 Capacity with Reduced Hydrogen Pressure

Generator shall be capable of operating at reduced capacity at reduced generator hydrogen pressure in accordance with values furnished by the Bidder in his proposal and accepted by the Owner.

4.03.08 HP/LP Bypass Capabilities

- i. HP/LP bypass capacity and capabilities under various modes of operation shall be demonstrated.
- ii. Condenser performance with HP-LP Bypass operating at rated conditions.

4.03.09 Lube Oil Purification System - Capacity and Purity

Lube oil purification system capacity and the purity of purified oil at the outlet of the centrifuge and the outlet of the polishing filter, shall be demonstrated. If purity check is not possible at site, this shall be carried out at Vendor's works.

4.03.10 Extraction and CRH NRVs

Operation of the valves under turbine trip and high water level in the heaters, shall be demonstrated.

4.03.11 The performance of the condenser, i.e., the back pressure achieved at design CW flow and inlet temp. and cleanliness factors, VWO heat load shall be demonstrated.

4.03.12 Temp. of condensate at outlet of condenser shall not be less than saturation temp. corresponding to the condenser pressure at all loads.

4.03.13 Oxygen content in condensate at hot-well outlet shall not exceed the limit prescribed by HEI over the entire load range and shall be determined according to an internationally approved codes/standard.

4.03.14 When one half of the condenser is isolated, condenser capability shall be demonstrated to take at least 60% T.G. load under TMCR conditions.

4.04.00 **Deaerator**

4.04.01 The dissolved oxygen content in feed-water measured at deaerator outlet shall not exceed 0.005 cc/litre at all loads from no load to VWO condition with 3% cycle make-up with normal pressure and overpressure with incoming condensate presumed to be saturated with oxygen (without any chemical dosing).

4.04.02 Free carbon dioxide in deaerator effluent shall be non-traceable at all loads from zero to VWO with 3% cycle make-up with normal pressure according to ASTM standards.

4.05.00 **Power Cycle Pumps**

Performance of each pump (flow, head, vibration, noise, parallel operation) to be demonstrated.

4.06.00 **Automatic On Line Turbine Testing (ATT) System**

Demonstrated without disturbing normal operation.

4.07.00 Coal Handling Plant

Refer Cl. No. 10.00.00 in Volume-IV-A.

4.08.00 Water Treatment System

Performance Guarantee of Chemical Feed System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-II-B of the EPC Bid Specification.

Performance Guarantee of Condensate Polishing System shall be in accordance with Cl. No. 8.04.00 in Section-VI, Volume-II-C of the EPC Bid Specification.

Performance Guarantee of River Water Pre-Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-I, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Demineralisation System shall be in accordance with Cl. No. 8.04.00 in Section-II, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Circulating Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-III, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Waste Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-III-C of the EPC Bid Specification.

4.09.00 Instrumentation and Control

The Bidder shall demonstrate that the Instrumentation and Control system meets all the functional/performance requirements, specified in technical specifications.

4.10.00 Noise Level

The Bidder shall demonstrate Noise Level of various plants/equipments/systems as per Clause no. 17.02.00 in Section-IV of Volume-II-A.

4.11.00 Air Conditioning & Ventilation system

The rating and performance figures of the AC & Ventilation system & equipment as indicated in the respective technical specification shall be guaranteed by the Bidder. In the event of any deficiencies in meeting the guarantees as indicated in the technical specification after conducting the performance test, the bidder shall put all his efforts to rectify the deficiencies or will replace the equipment / accessories to achieve the specified performance parameters within a reasonable time.

VOLUME : X

SECTION - II
GENERAL TECHNICAL REQUIREMENT FOR
PROCEDURE FOR CONDUCTING PG TESTS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	STEAM GENERATOR
2.00.00	MILL PERFORMANCE WARRANTY
3.00.00	ELECTROSTATIC PRECIPITATOR
4.00.00	TURBINE GENERATOR
5.00.00	STATUTORY REQUIREMENTS
6.00.00	REMAINING PLANT AND EQUIPMENT

VOLUME : X

SECTION-II

PROCEDURE FOR CONDUCTING PG TESTS

1.00.00 STEAM GENERATOR

The performance tests shall be conducted in accordance with the latest version of ANSI PTC 4.0 except for the specific requirements brought out herein below. This test shall be done simultaneously with PG test of Turbine Generator set. During this test, Boiler unit shall be fully on automatic control under steady load condition.

1.01.00 The efficiency tests shall be carried out with the steam generator operating at the guaranteed point condition i.e. corresponding to 100%, 80% Turbine rated loads, or at the agreed loads as near these as possible, with the boiler operating at the rated excess air, rated SH/RH attemperation flows, flue gas temperature, coal fineness, etc. corresponding to the loads on boiler. At control load, the stable and efficient operation of the unit with the rated excess air, rated mill outlet coal fineness, while achieving the rated S/H, R/H steam parameters shall be demonstrated by the Contractor to the satisfaction of the Owner.

1.02.00 For finding out the performance values, two sets of consistent reading shall be taken and the average of the above values shall be considered for the guarantee purpose.

1.03.00 Corrections shall be applied to the tested efficiency, to correct it to the design conditions, for variations in the following parameters only :

- a) Feed water temperature at economiser inlet.
- b) Ambient air temperature
- c) Relative humidity of ambient air.
- d) Hydrogen in coal.
- e) Moisture in coal.
- f) Gross calorific value of coal.

The Bidder shall furnish correction curves, for Owner's approval, covering the expected ranges of variations for all these parameters for the range of coals specified.

1.04.00 In all other aspects, not spelt out above, or in specifications, where ANSI code stipulates agreement between the parties concerned before the test, Bidder shall get these approved by the Owner.

- 1.05.00 No negative tolerance on account of instrument in-accuracies or otherwise shall be allowed on the guaranteed values.
- 1.06.00 Performance tests shall also be conducted to prove the steam generating capacity of the steam generator at rated parameters at stipulated loads.
- 1.07.00 Necessary write ups, schemes, instrument schedules, detailed procedures clearly indicating periods of tests, frequency of observations, etc. shall be prepared and submitted for all the tests for Owner's review and shall be got specifically approved from the Owner within one year of LOI issue.

2.00.00 **MILL PERFORMANCE WARRANTY**

- 2.01.00 Performance testing shall be done on the mill towards establishing its capacity specified at the specified fineness applying corrections for the variations in coal characteristics i.e. HGI, moisture, etc.

- 2.02.00 The Bidder shall guarantee a capacity output not less than the offered value, at each mill outlet, with coal fineness of not less than 70% through 200 mesh and not less than 98% through 50 mesh screen, when grinding coal having specified grindability index, total moisture content including surface moisture, etc. Bidder shall guarantee that the above capacity will be maintained and demonstrated with the originally installed grinding elements in nearly wornout condition as mutually agreed for the purpose of ascertaining wear life of any of the wear parts or when pulveriser grinding elements have successfully completed the specified guaranteed hours of operation as mentioned by the Bidder, whichever is earlier. During the above mentioned operating period of the mill, manufacturer's operation instructions will be followed and mill will be operated with the specified range of coal without any such readjustment that requires a shutdown of the mill or reduction of the load and/or any replacement of any mill wear parts.

For the purpose of testing to demonstrate the capacity, if grindability and surface moisture vary from those given above, the pulveriser measured capacity shall be corrected using the capacity correction curves furnished by the Bidder alongwith the offer. HGI vs grindability factor curve shall be furnished for HGI variations upto a value above which the capacity remains constant.

Capacity guarantee shall be conducted on all the mills. However, should the results of test as conducted above indicate that deficiency in capacity guarantee is observed in case of one or two mills only and that Owner is further, convinced that such deficiency does not occur out of reasons attributable to mill manufacture and supplier, Owner may waive off the requirement of demonstration of capacity guarantee for such mills only.

- 2.03.00 Mill Wear part life guarantee

The Bidder shall guarantee the wear life of all wear parts of the mill when grinding the specified range of coals. For this purpose the wear parts shall be defined as those parts of the mill which are in contact with coal or coal dust and are likely to wear out during the operation of the mill (except for the grinding

media balls). The guarantee shall be demonstrated on each mill during the guarantee trial period (GTP) commencing after establishing successful operation of the mill continuously for a period of not less than 24 hours at or near its guaranteed rated capacity. The guarantee trial period shall be at least five years or the wear life of any wear part, whichever is higher. The establishment of the guarantee will be based on actual total hours of operation of the mill regardless of the specified range of coal or fuel loading. The mill wear parts shall be considered to have passed their guaranteed operating life when they have demonstrated their capability to meet the full load rated capacity of the mill at the rated power consumption at the end of the guarantee trial period. In case any of the wear parts has worn out to such an extent that either the normal and safe operation of the mill is jeopardised if it is not replaced/repared or its continued use may lead to exposure or wear of other parts which are not meant for the purpose, that part shall be deemed to have completed its life for the purposes of checking the short fall in wear life even if there is no reduction in mill rated capacity and rated power consumption shall be as quoted by the Bidder when grinding the coal having parameters specified in Section-V and achieving the grind fineness of not less than 70% through 200 mesh and 98% through 50 mesh.

The Contractor shall provide to the Owner so as to compensate for the shortfall in wear life for a plant life of 30 years as has been established or the cost of such wear parts based on the prices quoted by him in his offer for spares escalated as applicable for respective items at the discretion of the Owner.

3.00.00 ELECTROSTATIC PRECIPITATOR

- 3.01.00 The performance test on electrostatic precipitator will commence after completion of reliability run along with the testing of Boiler and Turbine. During the interval between the commencement of trial operation and the commencement of performance test only routine maintenance shall be carried out. No physical or chemical cleaning of ESP shall be permitted during this period or immediately before the conductance of the performing tests.
- 3.02.00 The test efficiency shall be based on the overall performance of the electrostatic precipitator over a mutually agreed period of operation under the conditions given in this specification and following the normal operation of the unit including rapping and normal soot blowing and/or warm up guns. Outlet dust concentration of ESP shall be as specified in relevant section under Steam Generator subject to applicable modification adopted by Environmental Department, Government of India, at the time of project execution.
- 3.03.00 The performance tests shall be carried out in accordance with Method-17 of EPA (Environmental Protection Agency of USA) code. The details of the tests shall, however be mutually agreed upon between the Owner and the Contractor.
- 3.04.00 All calibration procedures and standards shall be subjected to the approval of the Owner. The protecting tubes, pressure connections and other test connections required for conducting guarantee test and maintenance testing shall conform to the relevant codes. The Bidder shall fully elaborate, in his proposal, the provisions made to this effect. Method of measurement for all air

leakage test and power consumption test proposed by the Bidder shall be clearly indicated in his offer, and shall be subject to Owner's approval.

4.00.00 TURBINE GENERATOR

4.01.00 The performance test for the turbine generator set will be conducted in accordance with the latest edition of ASME-PTC-6.

For determination of primary flow to the turbine, low beta ratio throat tap nozzle assembly including required machined straight length meeting the requirements of ASME-PTC-6 shall be provided.

4.02.00 The performance tests shall be carried out to determine compliance with the following heat balance conditions :

- a) 100% output under rated steam conditions at condenser CW temperature 33° C and condenser vacuum 77 mm HgA with zero make-up.
- b) 80% MW output under rated steam conditions at condenser CW temperature 33° C and condenser vacuum 77 mm HgA with zero make-up.

4.03.00 The test heat rate under the above load conditions shall be computed as per relevant clause of T.G. Specification.

The performance test shall be carried out with Turbine driven BFPs in service. To account for the conditions during the conductance of the test which do not correspond to the specified conditions, necessary corrections shall be applied.

4.04.00 No tolerance shall be applied to the final test results for testing inaccuracy. For measurement inaccuracies (including instrument tolerance) as ascertained by the Owner from the codes/standards, the test heat rates will be corrected upwardly reflecting the same (e.g. in case of any inaccuracy of 0.1%, the test heat rate will be corrected by 0.1% upwardly).

4.05.00 The tests shall be arranged in a manner such that the Owner's operation is not disrupted. Duplicate test run will be performed at the 100% and 80% unit loads. The test results of corrected heat rate of the duplicate test runs shall agree within 0.25%. If they differ by more than 0.25% a third test shall be run at the same test points. Corrected results of anyone of the three test runs which deviates from the corrected average heat rate of all the runs by more than 0.25%, shall be eliminated, otherwise the results of the test with the highest heat rate figure will be considered.

The test for TG test capacity shall be carried out alongwith the heat rate test. Instrumentation and other details shall comply as above.

4.06.00 Condenser

Performance test for the condenser shall be conducted in accordance with the latest edition of ASME PTC-12.2. The condenser pressure shall be measured at 300 mm above the top row of tubes under VWO condition, 3% make-up and

design CW flow and CW inlet temperature corresponding to guranteed vacuum. The cleanliness factor shall be determined in accordance with the latest edition of ASME PTC-12.2.

4.07.00 Feed Water Heaters and Drain Cooler

Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC-12.1.

4.08.00 Deaerator

Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC-12.3.

The dissolved oxygen content in feed water at outlet of deaerator shall be determined by ASME-D 888. Reference Method A and any recognised modification thereof.

Free carbondioxide content of deaerator effluent shall be measured by APHA method.

5.00.00 STATUTORY REQUIREMENTS

All parameters of plant, equipment & facilities which are under jurisdiction of Statutory Authorities, like MOEF, TPCB etc., shall be guaranteed. Conformance to the performance parameters under statutory requirement is mandatory.

6.00.00 REMAINING PLANT AND EQUIPMENT

For other equipment, plants and systems, the performance test shall be carried out as per the respective equipment specification and the applicable codes.

VOLUME : IIA

SECTION-IV

ADDITIONAL GENERAL TECHNICAL REQUIREMENTS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	CODES AND STANDARDS
2.00.00	RESPONSIBILITY FOR DESIGN
3.00.00	NAME PLATES (RATING PLATES)
4.00.00	SAFETY AND SECURITY
5.00.00	GUARDS
6.00.00	LOCATION AND LAYOUT REQUIREMENTS
7.00.00	OPERATION, MAINTENANCE AND AVAILABILITY CONSIDERATIONS
8.00.00	MATERIALS
9.00.00	LUBRICATION
10.00.00	LUBRICANTS & CONTROL FLUIDS
11.00.00	OPERATION AND MAINTENANCE
12.00.00	PLANT LIFE AND MODE OF OPERATION
13.00.00	PACKAGING & MARKING
14.00.00	PROTECTION
15.00.00	ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT
16.00.00	INSPECTION AND TESTING
17.00.00	TRAINING OF OWNER'S PERSONNEL
18.00.00	DEVIATIONS
	ATTACHMENTS
ANNEXURE-I	LIST OF STANDARDS FOR REFERENCE
ANNEXURE-II	CRITERIA FOR LAYOUT

VOLUME : IIA

SECTION-IV

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

- 1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.
- 1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
- 1.03.00 The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Explosives Act, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Contractor.
- 1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.
- 1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect.
- 1.06.00 Successful Bidder to furnish two (2) sets of latest of national/inter-national codes and standards to owner.

2.00.00 RESPONSIBILITY FOR DESIGN

- 2.01.00 The Contractor shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

- 2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.
- 2.03.00 The successful bidder shall have to carry out surge analysis, BFP transient analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.
- 2.04.00 The Bid shall include a detailed discussion on the development status of, and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.
- 2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.

3.00.00 **NAME PLATES (RATING PLATES)**

- 3.01.00 Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.
- 3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.
- 3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.
- 3.04.00 The size and location of nameplates shall be subject to Approval of the Engineer.

4.00.00 **SAFETY AND SECURITY**

- 4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and

property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

- 4.02.00 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.
- 4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.
- 4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.
- 5.00.00 **GUARDS**
- 5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.
- 5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.
- 5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.
- 5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.
- 5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

6.00.00

LOCATION AND LAYOUT REQUIREMENTS

The majority of plant and equipment (excluding steam generator and some other auxiliaries) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner/Engineer finds the proposal more attractive in terms of techno-economic consideration.

While developing the layout of buildings the following criteria shall be given effect :

- a) The minimum width of clear access corridors around equipment shall be 1.2 meter.
- b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.
- c) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of 2.5m shall be maintained between the floor and any overhead piping/ cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- d) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- e) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified

elsewhere in this specification shall be complied with.

- f) All rail/road crossings for pipe/cable racks shall be done with minimum 8 meters headroom from top of rail/road to bottom of rack. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II.
- g) Cubicle for operating personnel shall be located at safe place near the equipment.
- h) Interplant cable routing will be on overhead cable trays on pipe cum cable trestle or on cable trestle except where approved by purchaser/consultant. In exceptional case, small stretch of outdoor run of interplant cable routing may be taken through cable trench only with the Employer's prior approval.
- i) Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered to. Any departure from this suggestive layout is primarily not recommended.

7.00.00 **OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS**

7.01.00 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.02.00 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.03.0 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 3000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings.

No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating covering hoist at outdoor shall be provided.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

7.04.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common

components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.00.00 MATERIALS

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Owner to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.00.00 LUBRICATION

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.00.00 LUBRICANTS AND CONTROL FLUIDS

- 10.01.00 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of the unit.
- 10.02.00 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.
- 10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 OPERATION AND MAINTENANCE

- 11.01.00 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.
- The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.
- 11.02.00 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.
- 11.03.00 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.
- 11.04.00 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.
- 11.05.00 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.
- 11.06.00 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.00.00 PLANT LIFE AND MODE OF OPERATION

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

Cold start-up (>72 hrs. shutdown)	:	6 per year
Warm start-up (between 10 to 72 hrs. of shutdown)	:	40 per year
Hot start-up (less than 10 hrs. shutdown)	:	160 per year

13.00.00 PACKAGING & MARKING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

a)	Width of the Package (from centre-line of rails - 1.6 metres on both sides)	:	3.2 Meters
b)	Height of the package from rail top	:	4.47 Meters

The above indicates the dimensions which can be normally transported on the

wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

14.00.00 **PROTECTION**

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of

pipng, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.00.00 **ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT**

15.01.00 **Environment Protection**

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.

15.01.01 For Liquid Effluent

- a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.
- b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

15.01.02 For Air Emission

- a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out at TMCR).
- b) NO_x - 365 ppm Max. or 750 mg/Nm³ (Equivalent NO₂).
- c) SO₂ - Concentration based standard 2000 mg/Nm³. Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

15.02.00 **Noise Level Requirement**

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.

An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

16.00.00 **INSPECTION AND TESTING**

16.01.00 **Inspection and Tests during Manufacture**

16.01.01 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

16.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

16.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

16.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the

consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

16.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Owner's Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer along with Defect Map.

16.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.

16.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material or any other test as required by approved QAP/ Material specification.

16.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure or as required by design code of that part, for a period not less than one hour.

16.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

16.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnafux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.

16.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

16.02.00 **Performance Tests at Site**

- 16.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 16.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.
- 16.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.
- 16.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

17.00.00 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

17.01.00 Training at Contractor's Premises

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

Discipline	No. of Engineers	No. of Man-month
Operation	20 heads	20
Maintenance Boiler, Turbine, Mechanical	20 heads	20
Electrical Maintenance	8 heads	4
Control & Instrumentation	8 heads	4
Maintenance Planning	4 heads	2
	-----	-----

60 heads
-----60

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.
2. Plant operation and systems training for operators including simulator training as applicable.
3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training

coordinator(s) during the tenure of the training programme.

17.02.00 Operation and Maintenance Training at Site

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

- a) One (1) for Steam Generator and Auxiliaries ;
- b) One (1) for Turbine Generator and Auxiliaries ;
- c) One (1) for Electrical Works ;
- d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;
- e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

17.03.00 On-the-Job Training

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

17.04.00 For detail C&I training refer to Volume-VI, Section-9.

18.00.00 DEVIATIONS

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.

ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission (IEC) Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).

- x) Electric Power Research Institute (EPRI).
- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Dept. of Environment, Govt. of India
- hh) Central Board of Irrigation and Power (CBIP) Publications.
- ii) The Air Prevention and Control of Pollution Act.
- jj) The Environmental Protection Act
- kk) The Public Liability Insurance Act.
- ll) The Forest Conservation Act
- mm) The Wildlife protection Act.
- nn) The EIA Notification, 1994.
- oo) IS: 14665-Specification for Electric Traction Lift
- pp) Any other statutory Codes/Standards/Regulations

ANNEXURE-II

CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

ITEM	SPECIFICATION REQUIREMENT
A. Site conditions to be considered	
1. Prevalent wind direction	See wind-rose in plot plan. Also refer Metrological Data.
B. Layout Requirements	
1. Maximum permissible slope in	
a) Rail track	1 in 400
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
2. Required road width	
a) Main roads	Refer VII-A, B, C.
b) Auxiliary interconnections	Refer VII-A, B, C.
c) Road to the power house unloading bay :	
• Only for entry to the unloading bay	Yes
• To pass through the unloading bay	No
3. Required minimum horizontal distance between the nearest points of	
a) Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b) Electrical transformer and any other building/facility	As per the Tariff Advisory Committee/ LPA Rules
c) Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee/ LPA Rules
d) Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code

ITEM	SPECIFICATION REQUIREMENT
4. Required minimum vertical clearance	
a) Under pipes/cable racks at road crossings	8.0 Metres
b) Soil coverage over underground pipes	1.0 Metre (minimum)
5. Railway Wagon clearance	Rules of the Indian Railways
6. Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres
7. Required level, above the local developed grade level, of	
a) top of all roads	150 mm above FGL
b) all outdoor paved areas	100 mm above FGL
c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
d) Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

A. Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1. Horizontal, in all directions	
a) Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C.	1200 mm
b) Adjacent to any other plant facilities (including walls/structures)	1000 mm
2. Vertical (head-room clearance)	
a) Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.5 Metre
b) Under any other plant facilities (including structures, pipes etc.)	2.5 Metre

ITEM	SPECIFICATION REQUIREMENT
3. For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment
4. Minimum clear hand space required for	
a) The application of thermal insulation	100 mm
b) Welding work	150 mm
c) Bolt tightening	150 mm
B. Floors, platforms, staircase, ladders, walls, doors & windows	
1. Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2. Operation & Maintenance Requirement	
a) Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b) Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3. Plinth level of all buildings, above the finished grade level	500 mm
4. Minimum access opening required (with rolling shutter) for transportation, wherever entry of truck for material handling is envisaged	3.5M wide x 4M high or, more depending upon the equipment size to be handled.

ITEM	SPECIFICATION REQUIREMENT
C. Other Maintenance Requirement	
1. Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes
2. Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel oil pumps, filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3. Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4. Crane Approach Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D. Central Control Room	
All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes
The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
However, as a guide line, following features are given :	
a) False ceiling and false flooring shall be provided.	
b) Uniform height, colouring schemes for cabinets etc. shall be available.	

ITEM	SPECIFICATION REQUIREMENT
c) The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
d) No opening shall be provided from Boiler side.	
e) Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	
f) Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.	
g) The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.	
h) Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.	
i) Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.	
E. Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.

VOLUME : IIA

SECTION-VI

ENGINEERING SERVICES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL
2.00.00	DESIGN COORDINATION MEETING
3.00.00	CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS
4.00.00	GUIDELINES FOR ENGINEERING SERVICES
5.00.00	OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS
6.00.00	PLANT HANDBOOK
7.00.00	CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE
8.00.00	TENDER STAGE DOCUMENT SUBMISSION

ATTACHMENTS

ANNEXURE-1	DISTRIBUTION SCHEDULE

VOLUME : IIA

SECTION-VI

ENGINEERING SERVICES

1.00.00 GENERAL

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.00.00 DESIGN COORDINATION MEETING

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

4.00.00 **GUIDELINES FOR ENGINEERING SERVICES**

- 4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.
- 4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.
- 4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.
- 4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.
- 4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.
- 4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:
- 4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's

approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

- 4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.
- 4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.
- 4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.
- 4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.
- 4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.
- 4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.
- 4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.
- 4.06.09 Certification and submission of final as-built drawings for all areas.
- 4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.
- 4.06.11 All erection and assembly drawings which may be required at site.
- 4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)
- 4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector, Factory Inspector etc.

5.00.00 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies as per distribution schedule (Annexure-1).

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

- a) A complete inventory of all main items of plant, with identification details.
- b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.
- c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.
- d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.
- e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.
- f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 PLANT HANDBOOK

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Intent. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted as per distribution schedule.

7.00.00 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE

7.01.00 Within fifteen (15) days to one month of issue of Letter of Intent (LOI) by the Owner, the Contractor shall furnish a schedule of drawings and design

document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow two (2) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

- a) List of sub-vendors (from Owner only)
- b) System scheme and instrumentation diagrams
- c) Design basis justifying selection of equipment & process parameters where not specified in the Contract
- d) Equipment data sheets and general arrangement drawings
- e) Materials of construction
- f) Layout drawings.
- g) Operation logic diagrams.
- h) Typical control circuit.
- i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

- a) Equipment foundation drawings.
- b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
- c) Predicted performance curves of equipment.
- d) Various bills of quantity, schedules etc.
- e) Piping fabrication drawings, isometrics etc.
- f) Panel wiring diagrams.
- g) Instruction/Operation manuals.
- h) Service manuals and trouble shooting guide for C & I system including field instruments.
- i) Cable schedule and interconnection chart.
- j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

- a) A - Drawing submitted as approved, proceed with fabrication
- b) B - Drawing approved subject to comments noted, proceed with fabrication, considering our comments. Correct as necessary and resubmit for record.
- c) C - See attached memo.
- d) D - Correct your original drawing incorporating our comments and resubmit for approval.
- e) E - Information furnished is noted.
- f) F - Prints not enclosed

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

7.10.00 For details of documentation for Civil, Structural and Architectural works, VII-A, VII-B and VII-C may be referred.

8.00.00 **TENDER STAGE DOCUMENT SUBMISSION**

8.01.00 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following :

- a) All Bid proposal sheets duly filled up.
- b) Detailed experience list and financial resources of the prime bidder his collaborators/associates in this bid as well as the sub-vendors proposed.
- c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.
- d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

- e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.
- f) L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied; This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.
- g) List of suppliers for all bought out items.

ANNEXURE-1

DISTRIBUTION SCHEDULE

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

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

TSGENCO

: Telangana State Power Generation Corporation Limited

Director, Projects, Hyd

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

Director, Technical, Hyd	:	Director/ Technical, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ Civil, Hyd	:	Chief Engineer/Civil, Thermal Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ TPC-I, Hyd	:	Chief Engineer/TPC, TSGENCO, Vidyut Soudha, Hyderabad – 500 082
CE/ O&M/ KTPS	:	Chief Engineer(O&M), KTPS, Kothagudem, Telangana
SE/Civil, KTPS	:	Superintending Engineer (Civil), KTPS, Kothagudem, Telangana
SE/E&M, KTPS	:	Superintending Engineer (E&M), KTPS, Kothagudem, Telangana
DE/Constr./ KTPS	:	Divisional Engineer/Constuction, KTPS, Kothagudem, Telangana
M/s DCPL, Kolkata	:	M/s DCPL, Kolkata.
M/s DCPL, Hyd	:	M/s DCPL, Hyderabad.
M/s DCPL, KTPS	:	M/s DCPL, KTPS, Kothagudem, Telangana

VOLUME : IIA

SECTION-V

PROJECT MANAGEMENT AND SITE SERVICES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	PROJECT MANAGEMENT SERVICES
2.00.00	SITE SERVICES
3.00.00	PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)

VOLUME : IIA

SECTION-V

PROJECT MANAGEMENT AND SITE SERVICES

1.00.00 PROJECT MANAGEMENT SERVICES

1.01.00 Responsibility

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

- a) Planning and Monitoring
- b) Engineering Management
- c) Contracts Management
- d) Project Safety Management
- e) Quality Assurance, Inspection & Expediting
- f) Construction Management
- g) Spares Management
- h) Erection & Commissioning Management

Detailed responsibilities in the above areas are discussed below :

1.02.00 Organisation

1.02.01 Headquarters

The headquarters of the project management team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters relative to this contract.

1.02.02 Central Co-ordination Cell

The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or

references made by Owner and his Consultants without having the need to refer to his headquarters each time.

1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The schedule for the completion of the Project would be as follows :

	Period in Months from Zero date (Taken as advance payment date of EPC Package)
a) Boiler Hydro-test	By Bidder
b) Boiler light up	By Bidder
e) Commercial operation	50

To achieve these targets, the Contractor shall furnish to the Owner, various schedules as defined below:

1.03.01 Engineering Schedules

These schedules shall cover various design submissions indicating different engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment item covered in the scope of this specification.

1.03.02 Manufacturing Schedule

The Contractor shall submit to the Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Intent (LOI). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 Erection Schedules

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules alongwith requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, SAP.

1.04.00 Detailed Responsibilities

1.04.01 Planning & Monitoring

a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) Monitoring & Progress Reporting

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) Detailed packagewise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 Engineering Management

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for engineering activities.

Based on (L-2) network, the Contractor shall further develop the Level-3 (L-3) network for engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Intent and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software as well as in other format / software suitable to Owner.

The engineering management team should also co-ordinate all interface engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related engineering documentation before the same is submitted to the Owner.

TSGENCO is implementing SAP ERP. Hence the bidder apart from submission of the hard copies shall upload all the documents, drawings etc. in soft format in the relevant C- folder environment (web based) and comply with the additional requirements, if any.

1.04.03 Contracts Management

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of boughtout items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior

to placement of Letter of Intent. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner reserves the right to include vendors of his own choice. No further vendor approval will be given after twelve (12) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site upto erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05 Construction Management

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Intent, the Contractor shall submit a programme of construction/ erection/ commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

1.04.06 Spares Management

Alongwith the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

- a) Mandatory spares
- b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised thereafter.

1.05.00 Project Progress Review Meetings

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution of the project will be held initially at least once in two (2) months at Hyderabad/site/ at the discretion of the Owner.. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

1.06.00 Owner's Consultant

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner / Owner's Consultant and Contractor/ Contractor's project management team shall be finalised during contract negotiations.

1.07.00 Commissioning Management

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

- a) Steering Committee
- b) Commissioning Panel.
- c) Working Parties
- d) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the

following manner and submitted for Owner's approval :

a) Field Quality Plan

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

- i) Establish design data against which Plant Performance will be compared.
- ii) Set-out the testing objectives and proposals.
- iii) Define the documentation required.

b) Testing/Commissioning Schedule

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

c) Standard Check Lists

Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-a-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.

2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/ F.O.B. port of shipment by Contractor till receipt of the same at site.

- 2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area/ Road Transportation, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week as well as storing, preservation of material at site.
- 2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.
- 2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
- 2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning

- a) Deaerator
- b) Boiler feed suction, recirculation leak-off lines
- c) Boiler Feed discharge line by passing heaters
- d) Attenuation lines
- e) Condensate suction & discharge piping upto deaerator by passing the feed water heaters.
- f) Fuel oil lines.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

Safe disposal of effluent after chemical cleaning shall be done by the contractor.

- 2.07.00 Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of chemicals, lub oils and other consumables upto COD.
- 2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :
- 2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to

be rendered under this specification.

- 2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.
- 2.08.03 Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.
- 2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.
- 2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.
- 2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.
- 2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives, Electrical Inspector etc. for respective portions of work under the jurisdiction of such statutes or laws.
- 2.08.08 The Contractor shall provide 'Industrial Relations' unit and 'Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.
- 2.08.09 The successful Bidder shall arrange for Tower cranes of adequate capacity for speedy erection activities.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel

proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

2.10.00 General Guidelines for Field Activities

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication.

2.10.03 The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

2.10.05 The Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

2.10.06 The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.

- 2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.
- 2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.
- 2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.
- 2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer and as per the Standards.
- 2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.
- 2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :
- a) Product groups under which these items are re-leased are not covered in the scope of this tender.
 - b) Items are supplied by an agency other than the Contractor.
- 2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by

the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub. oil system, carryout the hydraulic test of oil coolers, etc.

- 2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackle, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.
- 2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.
- 2.10.16 Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.
- 2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.
- 2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.
- 2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.
- 2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.
- 2.10.21 For civil, structural and architectural works, volume VII-A, VII-B, VII-C may be referred. For Instrumentation and Electrical works Vol. VI, V-A and V-B may be referred.
- 2.11.00 **Safety**

Safety and overall cleanliness of work site shall be given top priority.
- 2.11.01 The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.
- 2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be

handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.

- 2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.
- 2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.
- 2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be done by the Contractor and certified copies shall be supplied to the Owner. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
- 2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.
- 2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.
- 2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.
- 2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.
- 2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.
- 2.11.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.
- 2.11.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.
- 2.12.00 **Taking Delivery & Storage**
- 2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the

materials so issued shall be submitted to the Owner.

- 2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.

- 2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.

- 2.13.00 **Site Welding & Heat Treatment**

- 2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.

- 2.13.02 All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.

- 2.13.03 The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.

- 2.13.04 All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.

- 2.13.05 All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.

- 2.13.06 Preheating/post heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing

type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Engineer prior to the commencement of each cycle and handed over to Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.

- 2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.

- 2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.

- 2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.

- 2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.

 Fillet weld shall be made by shielded metal arc process as per applicable codes.

 However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.

 In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.

- 2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.

- 2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.

- 2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

- 2.13.14 Each layer of welding shall have an even and smooth appearance.

- 2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.
- 2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surface to be welded are wet from any cause.
- 2.13.17 Following will be stages of inspection during welding :
- a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.
 - b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.
 - c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.
- 2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.
- 2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume : V, VI & VII of this specification.
- 3.00.00 **PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)**
- 3.01.00 Contractor shall submit as part of its Work Scope detailed documentation as outlined in this section and / or required by the Technical Requirements. The content and format of the documentation to be submitted are subject to Owner's approval.
- 3.02.00 Contractor shall utilise a computer based system for control and management of project documentation. The system must be capable of producing customized reports and information on demand. This control system should have been successfully applied to similar projects and be familiar to the project control personnel selected. Contractor's detailed project documentation plan shall identify all documentation requirements for the project, the party responsible for production of the document, the basic content of the document and the required timing for issue. This plan shall include, but not be limited to the details of all Drawings to be produced, plant specification / definition documentation, equipment orders and manuals. The documentation identified shall be entered into the computer based control system The database thus created shall be capable of being sorted and

ordered on a variety of selected parameters such as document type, subject description, responsible party, start date and finish date, to enable review and update to be conducted only on those documents which are relevant.

3.03.00 Regular documentation control progress reports shall be prepared by the Contractor to record the status of documentation. In the event either Party or Engineer expresses concern with the content of such progress reports, the accuracy of progress reports, status of documentation production and other such matters, the concern will be identified to the Project Manager. Within five days of notification of this concern, the Project Manager will attend a meeting with relevant Owner Representatives and provide details of specific actions to be initiated to satisfactorily overcome the difficulties identified. It will be the Project Manager's responsibility to initiate whatever action is necessary to ensure that the production of documentation is completely in accordance with Project Information Management System (PIMS).

3.04.00 Within 90 days after Effective Date of Contract, the Contractor shall establish an integrated PIMS which will support the needs of Project and management, detail design and engineering, procurement, construction and operation, and maintenance.

PIMS shall utilise software which links various software and database programs to form a composite system. The typical scope of PIMS shall include, but not be limited to, the following:

- (a) Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. The Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. This data shall include, but not be limited to, the following:
 - (i) System descriptions and design requirements and design criteria
 - (ii) Equipment and material technical specifications for all engineering disciplines
- (b) Detail engineering data to create flow diagrams, plant arrangements, piping configurations, equipment layout and design, electrical and instrumentation systems, structures, and other systems. The software tool used shall be capable of manipulation and storage of plant layout and design information. The 3D model of the plant shall also contain details of the various components like pipe, structural steel work, etc., and relevant information shall be available on-line from relevant data base. Software shall be multi-user, multi-access nature allowing the designers of Contractor and major Sub-Contractors, if required, to work in interactive real time environment and software shall be capable of interference checking. The software shall allow access to different types of information held in the database. It shall estimate the type and quantity of materials required to build the plant and it shall be possible for such data to be taken off the system at any time.

- (c) Construction data to monitor and manage site activities, including material control, scheduling and progress, quality control, start-up and testing, operation, maintenance, training, and all other site functions.
- (d) Plant design and construction records to provide data for safe and efficient maintenance and operation. Records to include may be maintenance schedule, man power tracking, tools, spare parts, and test equipment inventory, equipment list, drawing, control, technical specifications, and equipment instruction manuals.

3.05.00 The PIMS shall be installed in a distributed processing array system and operated through personal computer work stations at the Contractor's site office. A complete integrated system shall be implemented. This system shall be utilised by Contractor during the Project execution.



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: D2

REV NO: 00

DATE:

SECTION – D2
GENERAL TECHNICAL REQUIREMENTS
ELECTRICAL

VOLUME: V-A

SECTION-II

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

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

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-60034

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.

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.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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 Motors efficiency class shall be IE1, IE2 as per latest version of IEC-60034.
- 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. Breakaway starting current as percentage of full load current for various motor rating shall not exceed the given below-
- | | | |
|---------------------|---|---|
| Motors up to 1500kW | - | 600% subject to IS tolerance of plus 20%. |
| Motors above 1500kW | - | 450% not subject to any positive tolerance. |
- 5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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 3 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.
- 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).

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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. LT motors 15kW and above shall be provided with external greasing arrangement.
- 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.
- 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**

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 6.06.01 All HT motors shall be provided with vibration pads for mounting of vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in x&y direction with remote DCS monitoring, alarm and tripping.
- 6.06.02 The maximum double amplitude vibrations for HT motors upto 1500 rpm shall be 25 microns and 15 microns upto 3000 rpm. For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.
- 6.06.03 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.
- 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

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 Minimum Cable Size for LT & HT Motors shall as be as follows-

a) For 415V, 3-Ph, LT Motors-

Rating		:	Cable Size
Above	Up to		
-----	5.5 kW	:	1R X 3C X 6 Sq.mm
5.5 kW	11 kW	:	1R X 3C X 10 Sq.mm
11 kW	22 kW	:	1R X 3C X 35 Sq.mm
22 kW	37.5 kW	:	1R X 3C X 70 Sq.mm.
37.5kW	55 kW	:	1R X 3C X 150 Sq.mm
55 kW	75 kW	:	1R X 3C X 300 Sq.mm
75 kW	110kW	:	2R X 3C X 150 Sq.mm
110 kW	175kW	:	2R X 3C X 300 Sq.mm

b) For 3.3kV & 11kV, 3-Ph, HT Motors-

Rating		:	Cable Size
Above	Up to		

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

175 kW	1000 kW	:	1R X 3C X 240 Sq.mm
1000 kW	2000 kW	:	2R X 3C X 240 Sq.mm
2000 kW	4500 kW	:	2R X 3C X 300 Sq.mm
4501 kW	10,000 kW	:	9R X 1C X 1000 Sq.mm.

Note: During detail engineering if higher cable size is required same shall be provided.

6.10.00 Rating Plate

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

- a) Temperature rise in Deg.C under rated condition and method of measurement.
- b) Degree of protection.
- c) Bearing identification no. and recommended lubricant.
- d) 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

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.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 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. CACW motor shall be provided with water leakage detector with remote alarm and tripping.
- 7.04.03 Alarm switch contact rating shall be minimum 2.0 A at 220V D.C. and 10A at 240V A.C.
- 7.05.00 **Current Transformer for Differential Protection**
- 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

For paint shade finish, refer Section-X of Volume: II-A : Lead Specification.

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

- 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.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- h. Tan delta measurement on coils.
- i. Surge withstand test for inter turn insulation.
- j. Test to diagnose rotor bar failure during manufacture.
- k. Over speed test as routine test.
- l. Temperature rise test.

Temperature rise under normal condition above ambient temperature shall be limited to-

Specified Design Ambient temperature	Thermometer Method	Resistance Method
50 deg.C	60 deg.C	70 deg.C
45 deg.C	65 deg.C	75 deg.C
40 deg.C	70 deg.C	80 deg.C

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

9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 To be Submitted 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

9.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

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 1500 kW & above
M.V. Supply	3300 V, 3Ø, 3W, 50 Hz, Non-effectively earthed Fault level 40 kA symm. for 1 sec.	Motors 175 kW and Up to less than 1500 kW.
L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz effectively earthed Fault level 50 kA symm. for 1 sec.	Motors above 0.2kW and below 175kW.
	(ii) 240V AC/415V AC 240V, 1Ø, 2W, 50 Hz effectively earthed	Motors upto 0.2kW. Lighting, Space heat- ing , A.C supply for Contr- ol & 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 160-210 kW.
- 3.3 kV AC supply for CHP conveyor motors of rating above 160 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.

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

VOLUME: V-A

SECTION-III

TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE
2.00.00	STANDARDS
3.00.00	SERVICE CONDITIONS
4.00.00	RATING
5.00.00	PERFORMANCE
6.00.00	SPECIFIC REQUIREMENT
7.00.00	ACCESSORIES
8.00.00	TEST
9.00.00	DRAWINGS, DATA & MANUALS

ATTACHMENT

ANNEXURE-A	DESIGN DATA

VOLUME: V-A**SECTION-III**
TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS
1.00.00 SCOPE

- 1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves/dampers.
- 1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. All the electrical actuators shall be INTEGRAL type only.

2.00.00 STANDARDS

- 2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in 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-9334
 - ii) IS-325

3.00.00 SERVICE CONDITIONS

- 3.01.00 The actuator shall be suitable for operation 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 general specification.
- 3.03.00 For actuator motor installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 RATING

- 4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.
- 4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15
5.00.00 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.02.00 Attain full speed operation before valve load is encountered and imparts an unseating blow to start the valve in motion (hammer blow effect).
- 5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.04.00 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.05.00 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.00.00 SPECIFIC REQUIREMENT
6.01.00 Construction

- 6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.
- 6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.
- 6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 Motor

- 6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.
- 6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be with integral starter with 3phase/3wire, 415V AC and operable from remote.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.
- 6.03.04 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.
- 6.04.00 **Hand Wheel**
- Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **Wiring**
- All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. All the electrical actuators shall have uniform wiring.
- 6.08.00 **Terminal Box**
- The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.
- 7.00.00 **ACCESSORIES**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00 One (1) triple pole MCCB
- 7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V control transformer with primary & secondary fuses.

8.00.00 **TEST**

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 **DRAWINGS, DATA & MANUALS**

- 9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 **To be submitted with Bid**

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues. Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.03.00 **To be submitted for Owner / Purchaser's Approval and Distribution**

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	Motors above 0.2kW upto less than 175kW.
	Fault level 50 kA symm. for 1 sec.	
(ii)	240V AC/415V AC	Motors upto 0.2kW.
	240V, 1Ø, 2W, 50 Hz effectively earthed	Lighting, Space heat- ing , A.C supply for Contr- ol & protective devices.
D.C. Supply	220V, 2W, unearthed	D.C. alarm, control & protective devices
	Fault level 25* kA. for 1 sec.	

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

2.0 RANGE OF VARIATION

A.C. Supply :

Voltage	:	± 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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101 VOLUME NO. : II-B 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 SPECIFIATION 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: <table><tr><td>IS:325</td><td>Three phase Induction motors</td></tr><tr><td>IS : 900</td><td>Code of practice for installation and maintenance of induction motors</td></tr><tr><td>IS: 996</td><td>Single phase small AC and universal motors</td></tr><tr><td>IS: 4722</td><td>Rotating Electrical machines</td></tr><tr><td>IS: 4691</td><td>Degree of Protection provided by enclosures for rotating electrical machines</td></tr><tr><td>IS: 4728</td><td>Terminal marking and direction of rotation rotating electrical machines</td></tr><tr><td>IS: 1231</td><td>Dimensions of three phase foot mounted induction motors</td></tr><tr><td>IS: 8789</td><td>Values of performance characteristics for three phase induction motors</td></tr><tr><td>IS: 13555</td><td>Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment</td></tr><tr><td>IS: 2148</td><td>Flame proof enclosures for electrical appliance</td></tr><tr><td>IS: 5571</td><td>Guide for selection of electrical equipment for hazardous areas</td></tr><tr><td>IS: 12824</td><td>Type of duty and classes of rating assigned</td></tr><tr><td>IS: 12802</td><td>Temperature rise measurement for rotating electrical machnines</td></tr><tr><td>IS: 12065</td><td>Permissible limits of noise level for rotating electrical machines</td></tr><tr><td>IS: 12075</td><td>Mechanical vibration of rotating electrical machines</td></tr></table> In case of imported motors, motors as per IEC-34 shall also be acceptable.			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 machnines	IS: 12065	Permissible limits of noise level for rotating electrical machines	IS: 12075	Mechanical vibration of rotating electrical machines
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 machnines																															
IS: 12065	Permissible limits of noise level for rotating electrical machines																															
IS: 12075	Mechanical vibration of rotating electrical machines																															
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.																																

	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 : 2 OF 4
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.		

	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 : 3 OF 4
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.	
4.9	General	

	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 : 4 OF 4
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: <i>(To be given for motor above 55 kW unless otherwise specified in Data Sheet).</i> 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.		

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	1 OF 7

LT MOTORS**A. GENERAL**

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)

2. Equipment driven by motor

3. Motor type

4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size

2. Type of duty

3. Type of enclosure /Method of cooling/Degree of protection

4. Applicable standard to which motor generally conforms

5. Efficiency class as per IS 12615

6. (a) Whether motor is flame proof Yes/No

(b) If yes, the gas group to which it conforms as per IS:2148

7. Type of mounting

8. Direction of rotation as viewed from DE END__

9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)

10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)

11. Maximum continuous load demand of driven equipment in KW

12. Rated Voltage (volts)

13. Permissible variation of :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	2 OF 7

- a. Voltage (Volts)
 - b. Frequency (Hz)
 - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
 - a. Full load current
 - b. No load current
16. Power Factor at
 - a. 100% load
 - b. NO load
 - c. Starting.
17. Efficiency at rated voltage and frequency,
 - a. 100% load
 - b. 75% load
 - c. 50% load
18. Starting current (amps) at
 - a. 100 % voltage
 - b. 85% voltage
 - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
 - a. Without driven equipment coupled
 - b. With driven equipment coupled

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	3 OF 7

21. Safe stall time with 100% and 110% of rated voltage
 - a. From hot condition
 - b. From cold condition
22. Torques :
 - a. Starting torque at min. permissible voltage(kg-mtr.)
 - b. Pull up torque at rated voltage.
 - c. Pull out torque
 - d. Min accelerating torque (kg.m) available
 - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24. GD^2 value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation
 - a. Class & Type
 - b. Winding Insulation Process
 - c. Tropicalised (Yes/No)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	4 OF 7

- d. Temperature rise over specified maximum ambient temperature of 50 deg C
 - e. Method of temperature measurement
 - f. Stator winding connection
2. Main Terminal Box
 - a. Type
 - b. Location (viewed from NDE side)
 - c. Entry of cables(bottom/side)
 - d. Recommended cable size (To be matched with cable size envisaged by owner)
 - e. Fault level (MVA), Fault level duration (sec)
 - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
 - a. Motor stator (KG)
 - b. Motor Rotor (KG)
 - c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor)
(Nos./Power in watts/supply voltage)
2. Terminal Box for Space Heater (Yes/No)
3. Speed switch (Yes/No)
No of contacts and contact ratings of speed switch

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	5 OF 7

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box

7. Vibration pads

i) Nos and size

ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage

4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

i) Full load Armature current.(Amp)

ii) Full load Field current (Amp)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 DATE 08/09/2010	
		SHEET	6 OF 7

- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Armature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
 - i) Maximum permissible voltage
 - ii) Rated voltage
 - iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
 - i) Armature winding (Arm + IP + Series) at 25 deg.C
 - ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
 - i) Armature winding
 - ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
 - i) 220 V DC
 - ii) 250 V DC
 - iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 08/09/2010
		SHEET 7 OF 7

16. Starter resistance design calculation
17. Electrical connection diagram of motor

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

		QUALITY PLAN		CUSTOMER/ TSPGCL		PROJECT TITLE		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION :	
		BIDDER/ VENDOR				QUALITY PLAN				NUMBER :	
		SYSTEM				NUMBER PED-506-00-Q-006, REV-01		TITLE		SPECIFICATION	
		SHEET 1 OF 2				ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
									P	W	V
1	2	3	4	5	6	7	8	9	10		
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'R'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.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1	NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	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									

		QUALITY PLAN		CUSTOMER/ TSPGCL		PROJECT TITLE 1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER : SPECIFICATION : TITLE :																	
SHEET 2 OF 2		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SECTION AGENCY		VOLUME III REMARKS																	
COMPONENT/OPERATION		CHARACTERISTICS		CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD															
SL. NO.		2		3		4		5		6		7		8		9		10		11					
1		3		NAMEPLATE DETAILS		MA		VISUAL		100%		IS-325 & DATA SHEET		IS-325 & DATA SHEET		INSPN. REPORT		2		1		-			
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 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION. (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. (2) 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.		2		3		4		5		6		7		8		9		10		11	
Legends for Inspection agency		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	
BHEL		PARTICULARS		BIDDER/VENDOR		NAME		SIGNATURE		DATE		BIDDER'S/VENDORS COMPANY SEAL													

		QUALITY PLAN		CUSTOMER	TSPGCL	PROJECT	1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION :		
		SHEET 1 OF 9		BIDDER/ VENDOR	TITLE	NUMBER :	SPECIFICATION :				
							TITLE				
							NUMBER :				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL										
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	INSPEC. REPORT		3	-	2
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
						BIDDER'S/VENDORS COMPANY SEAL					

		CUSTOMER		TSPGCL		PROJECT TITLE		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER :													
SHEET 2 OF 9		QUALITY PLAN		BIDDER/ VENDOR		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE													
		CHARACTERISTIC CHECK		SYSTEM CAT.		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION AGENCY		VOLUME III REMARKS							
		1		2		3		4		5		6		7		8		9		10		11	
SL. NO.	COMPONENT/OPERATION	1. SURFACE COND.		MA		VISUAL		100%		-		FREE FROM VISUAL DEFECTS		-DO-		3		-		-		VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
1.5	SHAFT (FORGED OR ROLLED)	2. CHEM. & PHYSICAL PROPERTIES		MA		CHEM. & PHYSICAL TESTS		1/HEAT NO. OR HEAT TREATMENT BATCH NO		MFG. DRG. SPEC.		RELEVANT IS		SUPPLIER'S TC		3		-		2			
		3. DIMENSIONS		MA		MEASUREMENT		100%		-DO-		MANUF'R'S DRG.		LOG BOOK		3		-		2			
		4. INTERNAL FLAWS		CR		UT		-DO-		ASTM-A388		MANUF'R'S SPEC. BHEL SPEC.		-DO-		3		2		1		FOR DIA OF 55 MM & ABOVE	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING		MA		VISUAL		-DO-		MANUF'R'S DRG. SPEC.		MANUF'R'S DRG. SPEC.		-DO-		3		-		2			
		2. PHYSICAL COND.		MA		-DO-		-DO-		-		NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY		-DO-		3		-		2			
		3. DIMENSIONS (WHEREVER APPLICABLE)		MA		MEASUREMENT		SAMPLE		MANUF'R'S DRG. / SPEC.		MANUF'R'S DRG. / SPEC.		-DO-		3		-		2			
		4. PERFORMANCE/ CALIBRATION		MA		TEST		100%		-DO-		-DO-		INSP. REPORT		3		-		2			
BHEL		PARTICULARS		BIDDER/VENDOR																			
		NAME																					
		SIGNATURE																					
		DATE																					
		BIDDER'S/VENDORS COMPANY SEAL																					

		QUALITY PLAN		CUSTOMER		TSPGCL		PROJECT		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION :		
		SHEET 3 OF 9		BIDDER/ VENDOR		SYSTEM		TITLE		NUMBER :		SPECIFICATION :		
				QUALITY PLAN				TITLE				NUMBER :		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION			VOLUME III	REMARKS
1	2	3	4	5	6	7	8	9	10			11		
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2			
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2			
1.8		SHEET STAMPING (PUNCHEDED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-		
	CONDUCTORS	2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUF'S DRG. .	MANUF'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT		
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2			
1.9		1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.	
	BHEL	2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2			
		PARTICULARS		BIDDER/VENDOR										
		NAME												
	SIGNATURE													
	DATE													
													BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER TSPGCL		PROJECT TITLE		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER :		
SHEET 4 OF 9				BIDDER/ VENDOR		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME III			
									AGENCY	P	W	V
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		BHEL										
			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												

		QUALITY PLAN		CUSTOMER TSPGCL		PROJECT TITLE		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER :									
		SHEET 5 OF 9		BIDDER/ VENDOR SYSTEM		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION :									
				CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION AGENCY		VOLUME III REMARKS	
				3		4		5		6		7		8		9		10	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	1	2	3	4	5	6	7	8	9	10	11						
2.0	IN PROCESS																		
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA		VISUAL	100%	-DO-			GOOD FINISH	LOG BOOK	3/2	2	-					
2.2	MACHINING	2.DIMENSIONS	MA		MEASUREMENT	-DO-	MANUF'S DRG			MANUF'S DRG	-DO-	2	-	-					
		1.FINISH	MA		VISUAL	100%	-DO-			GOOD FINISH	LOG BOOK	2	-	-					
		2.DIMENSIONS	MA		MEASUREMENT	-DO-	MANUF'S DRG			MANUF'S DRG	-DO-	2	-	-					
		3.SHAFT SURFACE FLOWS	MA		PT	-DO-	RELEVANT SPEC./ASTM-E165			MANUF'S SPEC./BHEL SPEC./	-DO-	2	-	1					
2.3	PAINTING	1.SURFACE PREPARATION	MA		VISUAL	100%	MANFR'S SPEC./BHEL SPEC./RELEVANT STAND			BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-					
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA		MEASUREMENT BY ELCOMETER	SAMPLE	-DO-			-DO-	-DO-	2	-	-					
		3.SHADE	MA		VISUAL	-DO-	-DO-			-DO-	Log Book	2	-	-					
		4.ADHESION	MA		CROSS CUTTING & TAPE TEST	-DO-	-DO-			-DO-	Log Book	2	-	-					
BHEL			PARTICULARS		BIDDER/VENDOR														
			NAME																
			SIGNATURE																
			DATE																
					BIDDER/SVENDORS COMPANY SEAL														

		QUALITY PLAN		CUSTOMER	TSPGCL	PROJECT TITLE	1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER :			
		SHEET 6 OF 9					BIDDER/ VENDOR		SPECIFICATION : TITLE			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III REMARKS			
									P	W	V	
1	2	3	4	5	6	7	8	9	10	11		
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUF'R'S SPEC.	MANUF'R'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	Log Book	2	-	-
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	-DO-	Log Book	2	1*	1
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-
		6.SURGE WITH STAND AND TAN.DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	-DO-	Log Book	2	-	-
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
THREE DIPS TO BE GIVEN												
BHEL												
BIDDER/VENDOR												
PARTICULARS												
NAME												
SIGNATURE												
DATE												
BIDDER'S/VENDORS COMPANY SEAL												

		QUALITY PLAN		CUSTOMER		TSPGCL		PROJECT		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION :	
				BIDDER/ VENDOR		SYSTEM		TITLE		NUMBER :			
SHEET 7 OF 9		BIDDER/ VENDOR		SYSTEM		TITLE		NUMBER :		SPECIFICATION :			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III	REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10				11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-		
		1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
2.8	BRAZING/COMPRESSION JOINT	2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1		
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1		
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1		
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-		
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-		
		5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-		
		6. RTD ,BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1		
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
						BIDDER'S/VENDORS COMPANY SEAL							

		QUALITY PLAN		CUSTOMER	TSPGCL	PROJECT	1 X 800 MW KOTHAGUDEM TPS					SPECIFICATION :	
				BIDDER/ VENDOR	TITLE	QUALITY PLAN	NUMBER :					SPECIFICATION :	
												TITLE	
												NUMBER :	
SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		REMARKS			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	
1	2	3	4	5	6	7	8	9	10	11			
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3.VIBRATION & NOISE LEVEL 4.OVERALL DIMENSIONS AND ORIENTATION 5.DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & BTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1	
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2	
			MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	\$ NOTE - 2	
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-		
			MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2	
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2	
			MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	\$ NOTE - 2	
			MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
			MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2	
BHEL		PARTICULARS			BIDDER/VENDOR								
		NAME											
		SIGNATURE											
		DATE											
		BIDDER'S/VENDORS COMPANY SEAL											

		QUALITY PLAN		CUSTOMER TSPGCL		PROJECT TITLE		1 X 800 MW KOTHAGUDEM TPS		SPECIFICATION : NUMBER :			
SHEET 9 OF 9		QUALITY PLAN		BIDDER/ : VENDOR		SYSTEM		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION :			
								TITLE		TITLE			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	P	W	V	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11			
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 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. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <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							

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
 (dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

- B = 6.6KV (Power cables)
 C = 3.3KV (Power cables)
 D = 1.1KV (LV & DC system power & control cables)
 E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

- S = FIRE SURVIVAL CABLES
 T = TOUGH RUBBER SHEATH
 U = OVERALL SCREENED
 V = PAIRED OVERALL SCREENED
 W = PAIRED INDIVIDUAL SCREENED
 Y = COMPENSATING CABLES
 I = PRE-FABRICATED CABLES
 Z = JELLY FILLED CABLES



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: D3

REV NO: 00

DATE:

SECTION – D3
GENERAL TECHNICAL REQUIREMENTS
C&I

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	SPEC NO.: PE-TS-410-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 10.03.2015
		SHEET	OF

PLC SPECIFICATION

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

1.00.0 GENERAL

1.01.0 Each of the relevant BOP areas and different auxiliary systems shall be provided with dedicated PLC or proprietary control systems for overall operation and control.

1.01.01 There shall be redundant bidirectional OPC link between DDCMIS network and each Package PLC including PADO for monitoring / performance activities.

1.02.00 These control systems shall conform to high standard of engineering meeting all applicable codes and standard, design and workmanship and shall meet the functional requirements in all respects and shall be capable of performing satisfactorily in continuous commercial operation under the specified environmental condition.

1.03.00 Further this part of the specification details the common technical and functional requirements applicable for all the systems unless specified elsewhere in the specification. Only specific requirements are indicated in this section. However, Bidder shall also adhere to the Section-VI, Subsection A (DDCMIS) of this volume of the specification for other basic and detailed scope & services, philosophy & technical requirements of different hardware and softwares including response time, loading, interface, redundancy criteria, display, logs, spares criteria, drawings and document submission etc.

1.04.00 All local PLCs shall be supplied from one manufacturer for all plants and shall provide single unified hardware and software platform for realizing all the control and monitoring functions.

1.05.00 In general local PLC, Proprietary control system by third party system integrators shall not be allowed and only main PLC/ Proprietary control system manufacturer shall be allowed to do the design engineering, system integration etc. Owner will be the final authority in allowing third party system integrators, if required, for only small applications.

1.06.00 Local control and monitoring facility of the equipments from the respective package control room and local panels is required.

1.06.01 The redundant upper level network of each Package PLC system will be connected to redundant server to be located in Plant Engineer's room. Suitable Fibre optic cable shall be used for redundant interconnections.

1.06.02 The hot redundant Server shall continuously update all the inputs. The switchover to the hot standby Server shall be smooth and bumpless with proper indication to the operator.

1.06.03 Local PLC Workstations shall be capable of programming activities for control systems of the package including set point change, logic build up & modifications, graphics build up & modifications etc.

1.06.04 Programming shall not require special computer skills. On the programming console, it shall be possible to do the programming, self-diagnostics, testing of sequence, simulation and any sequence modification.

1.06.05 Alarm monitoring / reporting, generation of logs, trends, calculations, printing of logs & reports etc. shall be available in local workstations as well as in remote DDCMIS network workstations. In case of failure of DDCMIS network, control and monitoring of the individual packages shall still be possible from the Operator Work Stations in the respective package control room.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

1.06.06 The system shall permit carrying out of the on-line dynamic test and self-diagnostic checks while maintaining safe condition and without endangering the safety of equipment without having any influence on the process being controlled.

2.00.00 GENERAL TECHNICAL REQUIREMENTS

2.01.00 Bidders scope of supply shall include , but not limited to , Hot standby local PLC / Proprietary control & monitoring system for each of BOP areas and shall consist of IO cards, remote and Local IO rack, control rack, redundant Power supply modules, redundant communication / networking and interconnection Cables, redundant processor and communication cards, redundant Servers, operator work stations / GUI, LVS(if applicable) , printer, redundant networking hardware etc. , system cabinets ,startup, commissioning, mandatory and recommended spares, drawing, documents and training to owner's personnel at site and at vendors works etc.

2.02.00 All types of programming packages shall be licensed with facility of editing and configuration. For each of the PLC / proprietary control system, the programming software shall be supplied in a laptop for each package preloaded with package in addition to other types of devices such as CD, DAT etc.

2.03.00 In addition to the Operator and/ cum Engineering workstations, Bidder shall also supply LCD screen based display unit, control switches and other operational keys (GUI). Bidder shall also provide minimum of one no. laptop computer for each PLC based package and with latest hardware configuration and loaded with suitable operating, application program including licensed softwares as a backup engineering cum programming and configuration station. **This loaded laptop shall be handed over by Bidder well in advance of FAT to Owner's head office at Hyderabad.**

2.04.00 The System shall allow dependable and effective control of the process equipment and shall be designed for maximum integrity and reliability. Integrity shall be maintained by providing a dual hot redundant system. The System shall have a capability to monitor and take actions for distributed functions from a central location.

2.05.00 The control & Instrumentation shall be through dedicated microprocessor based PLC, Common DDCMIS network, proprietary system for the each of the respective plants covering the total functional requirement of sequence control, regulatory control, interlock & protection, monitoring, alarm, data logging.

2.06.00 The loop cycle time shall be less than 1 sec for close loops and open loops. The switchover from main controller to redundant controller shall be bump less; and shall be within one cycle time i.e. within 50 msec.

2.07.00 Each controller shall have 40% functional capacity to implement additional functional blocks over and above implemented logic / loops under worst loading conditions.

2.08.00 Field Input/Outputs

The System shall meet the following I/O card requirements. The maximum number of inputs / outputs to be connected to each type of module shall be as follows:

a)	Analog input module	8
b).	Analog output module	8
c)	Binary input module	16
d)	Binary output module	16

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15
2.09.00 Communications System

2.09.01 The Bidder shall include a dual hot redundant communication system

2.09.02 The data highway speed shall be 100 Mbps.

2.10.00 Operator Interface

Operator Work Station (OWS) / GUI / LVS shall perform control monitoring and operation of all auxiliaries/ drives. However, Push button stations are also to be provided with RIOs.

2.11.00 Interface with Common DDCMIS system

Each PLC, proprietary control systems shall be interfaced to Common DDC MIS network with bidirectional OPC link. The link shall be redundant.

2.12.00 PLC shall be of latest version and all the modules like Control modules, communication modules, IO modules, and network interface modules etc., modules shall be from the same family of hardwares and softwares and shall be sourced from Bidder's Original Principal's works.

2.13.00 PLC shall have also, but not limited to, the following requirements,

2.13.01 I/O LAN Speed shall be minimum 5 Mbps - 100 MBPS on Deterministic LAN.

2.13.02 I/Os shall be Rack based and not Din Rail Mountable.

2.13.03 Processors and I/Os shall be of same family.

2.13.04 Diagnostics for DI/DO, AI & AO shall be provided.

2.13.05 All PLC I/O Rack Power Supplies shall be redundant. Only Bulk power supply redundancy will not be acceptable.

2.13.06 Processor selection shall be such that it shall never be loaded more than 50% at any time during the operation.

2.13.07 SOE module (if applicable) must stamp and store 250+ events at card level.

2.13.08 PLC shall store tag details and bit word addresses on upload of logic as well as tag descriptions.

2.13.09 Remote I/O Rack outside control room shall be on Fiber Optic communication only.

2.13.10 Processor shall be self learning in case of failure. No need to configure and program replaced processor.

2.14.00 Operating work stations must be Run time license/servers. Client server architecture not acceptable.

2.15.00 Each operator work station must have minimum 150% tags handling capability.

2.16.00 Auto Tuning feature of PIDs at PLC controller level shall be available.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

2.17.00 Programming facility shall be available from Remote IO stations.

2.18.00 Processor shall support minimum twice the overall system IO handling capacity in Redundant configuration.

2.19.00 Online editing of Program shall be possible.

2.20.00 Processors shall be Hot back up.

2.21.00 Automatic synchronization of primary processor/controller of PLC with secondary processor/controller.

2.22.00 Bumpless switchover to secondary processor/controller of PLC when the primary fails.

2.23.00 Power supply module redundancy shall be true power supply redundancy

2.24.00 Automatic program and data equalization of primary processor/controller of PLC.

2.25.00 Automatic 'Forcing Bit' update in the secondary processor/controller of PLC when any Forcing is applied in the primary processor/controller of PLC. (Forcing Bit Table of both the PLCs must be automatically synchronised.)

2.26.00 Softwares

The latest version of all necessary applications and networking software shall be supplied for the system. The software tool shall have facility to interface with third party software packages. Window base operating system shall be provided. The system shall be OPC compliant. Easy upgradation and future expansion facility shall be available.

All softwares used shall be licensed versions only. All software user licenses shall be valid for entire life of power plant. User shall not have to pay any recurring license fee during the usage period of the system.

It shall be possible to upgrade the installed system with the latest available version of the software model during the plant life.

2.23.00 Redundant Uninterrupted Power Supplies (UPS) shall be provided for each Local PLC.. UPS specification shall be as per requirements indicated in Section V of this specification.



Technical specification for
CONTROL & INSTRUMENTATION
1X800 MW KOTHAGUDEM

SPEC NO.: **PE-TS-410-145-I**

VOLUME

SECTION

REV. NO.

00

DATE : 10.03.2015

SHEET

OF

PLC DATA SHEET

	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.: PE-TS-410-	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 04.03.2015
			SHEET 1 OF	1
Data Sheet No.:				
Data Sheet A&B				
DATA SHEET – A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)			DATA SHEET – B FOR PLC SYSTEM (TO BE FILLED BY BIDDER)	
GENERAL	PROJECT	1X800MW KOTHAGUDEM TPS		
	SERVICE			
	QUANTITY	☐ UNITISED ☒ COMMON		
	LOCATION	☒ INDOOR ☐ OUTDOOR ☒ AC ☐ NON-AC*		
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE		
	PROCESSOR	REDUNDANT WITH HOT STANDBY		
	DATA BUS (HMI)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (REMOTE I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	FIELD CONTACTS INTERROGATION VOLTAGE	☒ 24 V DC ☐ 48 V DC ☐ 110 V AC		
	LOCATION OF COUPLING RELAYS	☐ MCC ☒ PLC PANEL		
	DESKTOP OWS QUANTITY	☐ ONE ☐ TWO ☐ _____ ☒ DESKTOP VERSION ☐ SERVER VERSION ☐ WORK STATION VERSION REQUIREMENT OF OWS IN CCR ☐ YES ☐ NO QUANTITY _____		OWS, EWS and LVS shall be as per PLC Configuration diagram attached elsewhere in the specification.
	DESKTOP MONITOR TYPE	☐ 19" ☒ 24" TFT/CRT MONITOR ☐ GIU ☐ OTHERS		
	PRINTER	INKJET ☐ A3 ___ NOS ☐ A4 ___ NOS LASER B/W ☐ A3 ___ NOS ☐ A4 ___ NOS COLOR INKJET ☐ A3 ___ NOS ☐ A4 ___ NOS COLOR LASER ☒ A3_1_NOS ☐ A4 ___ NOS		
PROGRAMMING / CONFIGURATION FACILITY	A) ☐ HAND HELD ☒ LAPTOP B) ENGINEERING SOFTWARE ☐ ONE OWS ☐ ALL OWS ☐ LAPTOP		OWS, EWS and LVS shall be as per PLC Configuration diagram attached elsewhere in the specification. One number Laptop is mandatory.	
SAFETY STANDARD	☐ SIL-3 ☐ SIL-2 ☒ NIL			
	COMPUTER FURNITURE	BOQ ☒ YES ☐ NO INDUSTRIAL GRADE ☒ YES ☐ NO ☐ START UP & COMMISSIONING		
SPARE LIST	SPARE LIST	☒ MANDATORY SPARE ☐ RECOMMENDED		
	SPARE LIST ATTACHED	☒ YES ☐ NO		
REDUNDANCY	CPU	☒ YES ☐ NO		
	POWER SUPPLY	☒ YES ☐ NO		
	COMMUNICATION	☒ YES ☐ NO		
	I/O CARD	☐ YES ☐ NO		
	OTHER ELECTRONICS	☐ YES ☐ NO		As per vendor practice

	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.: PE-TS-410-	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 04.03.2015
			SHEET 1 OF	1
Data Sheet No.:				
Data Sheet A&B				
DATA SHEET – A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)			DATA SHEET – B FOR PLC SYSTEM (TO BE FILLED BY BIDDER)	
No. of CHANNELS PER CARD	ANALOG INPUT	☒ 8 NOs ☐ 16 NOs		
	ANALOG OUTPUT	☒ 8 NOs ☐ 16 NOs		
	BINARY INPUT	☒ 16 NOs ☐ 32 NOs		
	BINARY OUTPUT	☒ 16 NOs ☐ 32 NOs		
	RTD** 4	NOs		
	THERMOCOUPLE** 8	NOs		
	ELECTRONIC CARD ISOLATION	☐ GALVANIC ☐ OPTICAL ☐ OTHER		
PANEL	QUANTITY BI	DDER TO INDICATE		
	CLASS OF PROTECTION(Refer Location of PLC)	☒ IP-42		
	REMOTE I/O PANEL	☒ YES ☐ NO AC REQUIREMENT ☒ YES ☐ NO		
	COLOUR# RAL	7032		
	BACK-UP DESK	☐ YES ☒ NO		
	MIMIC	☐ YES ☒ NO IF YES, THEN ☐ PANEL MOUNTED GUI ☐ ACRYLIC		
	CONTROL HARDWARE	☐ PB ☐ INDICATORS ☒ FACIAS 25 Nos. ☐ OTHERS		
	CONFORMAL COATING	☐ YES ☒ NO		
COMMUNICATION WITH OTHER SYSTEM	HARDWIRED	☒ YES ☐ NO		
	PURPOSE	☐ CONTROL ☒ MONITORING		
	MEDIUM	☐ UTP ☒ FIBRE OPTIC ☐ OTHERS		
	TIME SYNCHRONIZATION SIGNAL FORMAT	☐ PULSE ☐ RS-485 ☒ IRIG-B ☐ NTP		
	SOFTLINK	☐ MODBUS ☒ OPC IF MODBUS THEN ☐ RS-485 ☐ ETHERNET		
	SERIAL LINK	COMMUNICATION PORT TYPE _____		
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA		
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA		
POWER SUPPLY	SOURCE \$\$	☒ UPS(INDUSTRIAL GRADE) ☐ 24V DC CHARGER		
	BATTERY TYPE	☐ Ni-Cd ☒ LEAD ACID ☐ OTHERS		
	BACK-UP TIME	☐ 30 MINS ☒ 60 MINS ☐ OTHERS		
	BATTERY CONFIGURATION	☐ 1X100% ☒ 2X100% ☐ 2X50%		As per MAX philosophy
CUSTOMER TRAINING	TRAINING	☒ REQUIRED ☐ NOT REQUIRED		
	NO OF DAYS	3 DAYS		
	LOCATION	☐ VENDOR'S WORK ☐ PROJECT SITE ☐ OTHERS		

*IF THE LOCATION IS INDOOR,KINDLY SPECIFY IF PLC PANEL IS PLACED IN AC OR NON-AC ENVIRONMENT.

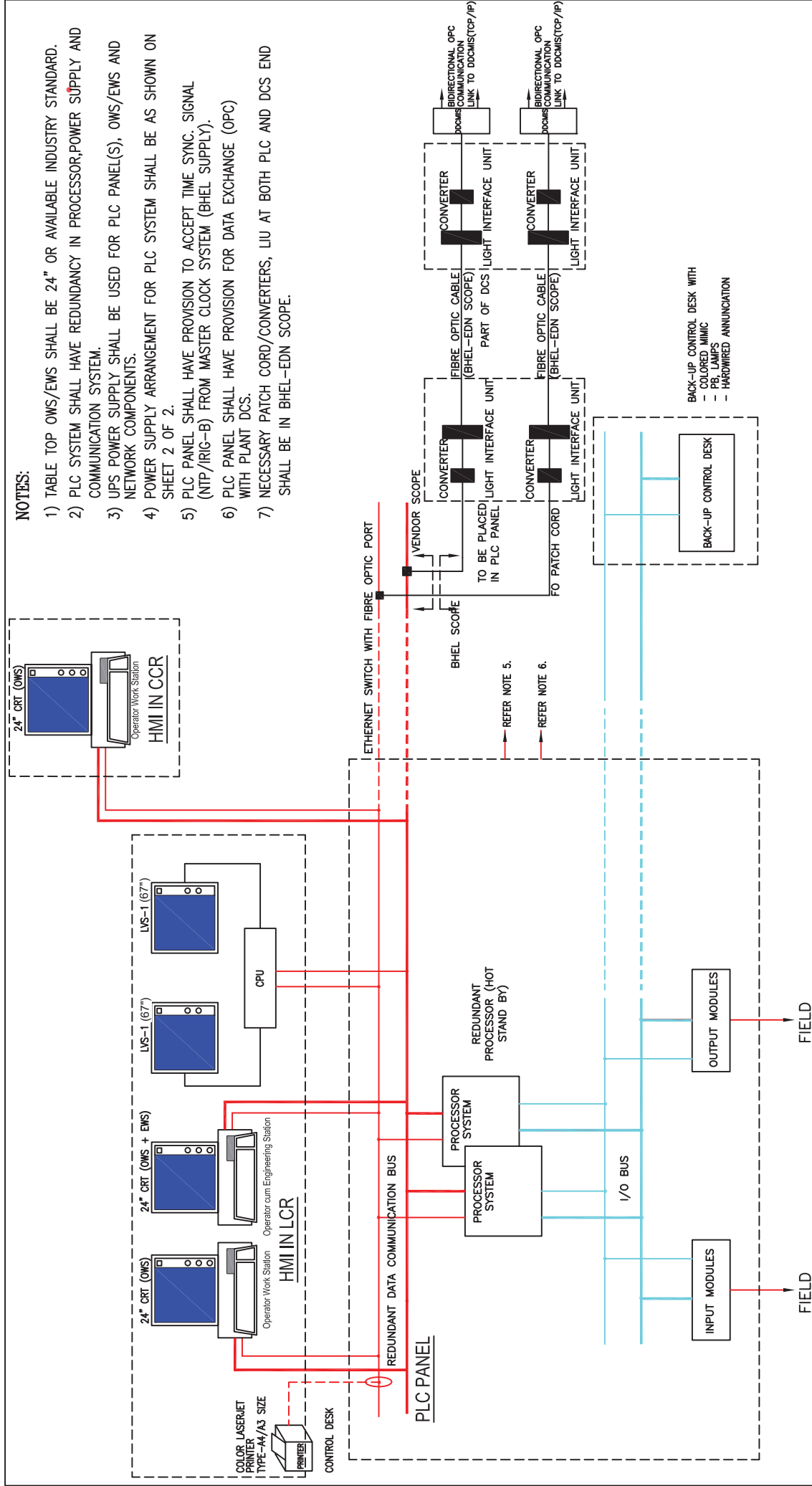
**SHALL NOT BE APPLICABLE IF TEMPERATURE TRANSMITTERS ARE ENVISAGED.

PROJECT SPECIFIC PAINT SHADES, IF APPLICABLE TO BE USED.

\$\$ CHECK & REPLACE WITH MAIN UPS SLD IF POWER SUPPLY IS NOT APPROVED BY CUSTOMER.

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM		SPEC NO.: PE-TS-410-145-I	
			VOLUME	
			SECTION	
			REV. NO.	00
			DATE : 10.03.2015	
		SHEET		OF

PLC CONFIGURATION



PROJECT:

1X800 KOTHAGUDEM TPS
STAGE-VII, UNIT-12

DRG.NO.

PE-DM-410-145-1900

TITLE:

PLC CONFIGURATION DM PLANT &
POTABLE WATER

DATE

23.02.2015

REV.NO.

00

SHT

6 OF 11

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	SPEC NO.: PE-TS-410-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 10.03.2015
		SHEET	OF

PLC Quality Plan

 PEM :: C&I		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036			
												VOLUME IIB			
												SECTION D			
												REV. NO. 01 DATE: 24.08.2007			
												SHEET 1 OF 8			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
1.0	Materials /Components														
1.1	Panels & Control Desks	Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA Visua	I	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1				
1.2	Power Supply/Packs, Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA Visua	I	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1				
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers	Physical Verification Physical Damages Dimensions Accessories	MA Visua	I	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1				
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet	Physical Inspection - Identification Labels - Physical Damages - Quantity - Spare Capacity	MA Visua	I	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1				

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER						QUALITY PLAN NO.: PE-QP-999-145-1036 _____				
								VOLUME IIB				
								SECTION D				
								REV. NO. 01		DATE: 24.08.2007		
								SHEET 3		OF 8		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	

2.0	Assembly											
2.1	Functional Test for HMI/OWS devices such as Monitors, Keyboards, Mouse, Printers etc.	Operation	MA	Functional	100%	Approved Configuration Diagram & BOQ and FAT	Correct Operation of interconnected Devices of HMI system.	BHEL Quality Inspection Report.	2 1		1	
2.2	Hardware Functional Verification.	Physical arrangement, Wiring check & labeling, Continuity Checking, IR & HV test	MA	Visual/ Electrical	100%	Approved GA Drawing, Panel Wiring Diagram, IR & HV as per relevant International standard	Test Certification	BHEL Quality Inspection Report.	2 2		1	
2.3	Powering Up	Healthiness of all the modules/equipment, associated with Powering of PLC system	MA	Visual /Electrical	100%	Approved power supply scheme	All equipment to be healthy on power ON	BHEL Quality Inspection Report.	2 1		1	
2.4	Burn in test for PLC modules	Healthiness of PLC modules on Continuous Energisation, Temperature maintenance	MA	Visual/ Electrical	100% F	AT Procedure	Test certification as per FAT	BHEL Quality Inspection Report.	2 2		1	

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics

\$ P W V
 - Agency Performing the Test.
 - Agency Witnessing the Test.
 - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

 PEM :: C&I	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER						QUALITY PLAN NO.: PE-QP-999-145-1036 _____					
							VOLUME IIB					
							SECTION D					
							REV. NO. 01		DATE: 24.08.2007			
							SHEET 4		OF 8			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	

3.0	Factory Acceptance Test (FAT)											
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/ Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.6	Control Panel/Desk Verification	Operation of PLC driven annunciation system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1			1

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P W V
- Agency Performing the Test.
- Agency Witnessing the Test.
- Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.: PE-QP-999-145-I036 ___		
VOLUME IIB		
SECTION D		
REV. NO. 01	DATE: 24.08.2007	
SHEET 5	OF	8

FACTORY ACCEPTANCE TEST (FAT) PROCEDURE

This document covers procedure to conduct/witness PLC system functional tests in order to demonstrate conformity to purchase specifications and related engineering documents. The test shall be conducted at the system suppliers works. The system supplier shall conduct all functional tests before commencing FAT and test results shall be made available during FAT. Vendor must furnish following relevant drawings, duly approved by BHEL Engineering, for reference during FAT.

- a) Technical Specification of PLC.
- b) PLC System Configuration
- c) General Assembly Drawings.
- d) Panel Wiring Diagrams.
- e) Bill of Quantity for PLC System.
- f) Logic Diagram.
- g) HMI Schematics.
- h) Input / Output List.

Further the vendor shall furnish applicable product specification, datasheets, catalogues, test-certificates, and internal inspection records to enable FAT. Vendor shall also submit, [to the inspecting agency](#), his standard test procedure, for clauses given below; where vendor's standard practice has been referred.

APPLICABLE TEST PROCEDURE:

1. Input/Output Functional Verification.

Check for correctness of addressing of racks, slots and I/O modules as per applicable PLC configuration diagram. Appropriate signal generators shall be used to simulate Inputs and outputs to check operation and SCAN time. [Check online replacement of cards, processors, power supply etc.](#)

2. Processor Verification

PLC Configuration drawing to be referred for ascertaining

- i) Redundancy

STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.: PE-QP-999-145-I036 ___		
VOLUME IIB		
SECTION D		
REV. NO. 00	DATE: 23.03.2005	
SHEET 6	OF	8

ii) Type (Hot or Cold)

Both the processors are to be checked for healthiness in case of redundant configuration as per vendor's standard practice. In case of hot redundancy, switchover of control from primary processor to standby processor shall be demonstrated for uninterrupted control and data processing as per vendor's standard practice. Switchover shall be witnessed, by manual power off or resetting the Primary CPU or simulating failure of primary processor. Checking should be by witnessing the lighting up of Processor's LEDs as per manufacturer's product standard.

Vendor shall demonstrate, as per Vendor's standard practice, adequate Loading (Spare Capacity) of Processors, as mentioned in contract specs. This shall be done, by simulating worst load operation of fully integrated PLC system.

3. Power Supply Module Verification

Check if PSM is in redundant mode as per specification. Check the healthiness of power supply from both the modules' lamp indication/measurement. Simulate failure of one PSM and verify that standby PSM has taken over without any interruption.

4. Communication System Verification

Communication system has to be in line with approved PLC Configuration Diagram. Verify that both the communication buses are intact and connected. Communication between PLC processors, I/O rack, OWS etc. is to be checked through simulation of input data. Simulate the bus failure by disconnection of working bus. Check that the communication continues without interruption or loss of data.

Following response times are to be demonstrated as per vendor's standard practice for conformance to contract specifications:

1. Screen update time
2. I/O scan time
3. SOE resolution time
4. Data transfer time with third party system using Communication Protocol as per Contract specification and as per quantum of data as per approved signal exchange list.

5. Diagnostic Verification

Product Catalogue/Literature shall be referred for checking of all diagnostic features. Hardware failure to be simulated by removing an I/O

STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

QUALITY PLAN NO.:	PE-QP-999-145-I036
VOLUME	IIB
SECTION	D
REV. NO.	00
DATE:	23.03.2005
SHEET	7
OF	8

6. Control Panel /Desk Verification

- i) PLC driven annunciation system should be checked by alarm signal simulation.
- ii) Push Button and selector switch operation should be checked by verification of corresponding change of status of Data Base point.
- iii) Indicating lamp / MIMIC should be checked by corresponding Data Base point simulation.

7. Software Verification

- i). Control Logics:– Software switches, lamps and Analog sources shall be used for simulation of field conditions .Control logics shall be checked for its correct functionality as per approved logic schemes
- ii). Engineering features:-
 - a) Online changing of parameters, set points.
 - b) Online modification in Control Logic Diagrams.
 - c) Online configuration of Graphics, Trends, Logs, HSR.
- iii). HMI features:-
Check for configuration & operation of Graphics, Trends, Logs, HSR and Alarms, in the form of Displays and Printouts, by simulation of Inputs as per approved documents.

8. Burn in Elevated Temperature test

Electronic equipments shall be subjected to Burn in elevated temperature test as per the procedure detailed below:

- a) (i) PLC modules are kept at 50 Deg c under continuous energized condition for 48 hours.

**STANDARD QUALITY PLAN
FOR
PROGRAMMABLE LOGIC CONTROLLER**

QUALITY PLAN NO.: PE-QP-999-145-I036		
VOLUME IIB		
SECTION D		
REV. NO. 00	DATE:	
23.03.2005		
SHEET 8	OF	8

ii) 48 hours test period shall be divided into 4 equal time segments of 12 hours duration each. For every 12 hours duration segment, after lapse of first 11 hours 110% of nominal voltage shall be applied to the panel under test for a period of 30 minutes followed by application of 90% of nominal voltage for the next 30 minutes.

b) Assembled Panels with complete wiring shall be kept under continuous energized condition for 120 hours at ambient temperature. Temperature rise in panels should be below 10 Deg C above ambient.

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM		SPEC NO.: PE-TS-410-145-I	
			VOLUME	
			SECTION	
			REV. NO.	00
			DATE : 10.03.2015	
		SHEET		OF

ACTUATOR SPECIFICATION

VOLUME: V-A**SECTION-III**
TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS
1.00.00 SCOPE

- 1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves/dampers.
- 1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. All the electrical actuators shall be INTEGRAL type only.

2.00.00 STANDARDS

- 2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in 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 -9334
 - ii) IS-325

3.00.00 SERVICE CONDITIONS

- 3.01.00 The actuator shall be suitable for operation 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 general specification.
- 3.03.00 For actuator motor installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 RATING

- 4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.
- 4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15
5.00.00 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.02.00 Attain full speed operation before valve load is encountered and imparts an unseating blow to start the valve in motion (hammer blow effect).
- 5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.04.00 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.05.00 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.00.00 SPECIFIC REQUIREMENT
6.01.00 Construction

- 6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.
- 6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.
- 6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 Motor

- 6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.
- 6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be with integral starter with 3phase/3wire, 415V AC and operable from remote.

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.
- 6.03.04 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.
- 6.04.00 **Hand Wheel**
- Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall disengage automatically when the motor is energized.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **Wiring**
- All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100 V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. All the electrical actuators shall have uniform wiring.
- 6.08.00 **Terminal Box**
- The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.
- 7.00.00 **ACCESSORIES**

Telangana State Power Generation Corporation Ltd
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00 One (1) triple pole MCCB
- 7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V control transformer with primary & secondary fuses.

8.00.00 TEST

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 DRAWINGS, DATA & MANUALS

- 9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 To be submitted with Bid

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues. Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.03.00 To be submitted for Owner / Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A : Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

S	upply	Description	Consumer
	L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	u Motors above 0.2kW pto less than 175kW.
		Fault level 50 kA symm. for 1 sec.	
	(ii)	240V AC/415V AC	Motors upto 0.2kW.
		240V, 1Ø, 2W, 50 Hz effectively earthed	o Lighting, Space heat- ing , A.C supply for Contr- l & protective devices.
	D.C. Supply	220V, 2W, unearthed	& D.C. alarm, control protective devices
		Fault level 25* kA. for 1 sec.	

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

2.0 RANGE OF VARIATION

A.C. Supply :

V	oltage	:	± 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

FORM NO. PEM-666-0

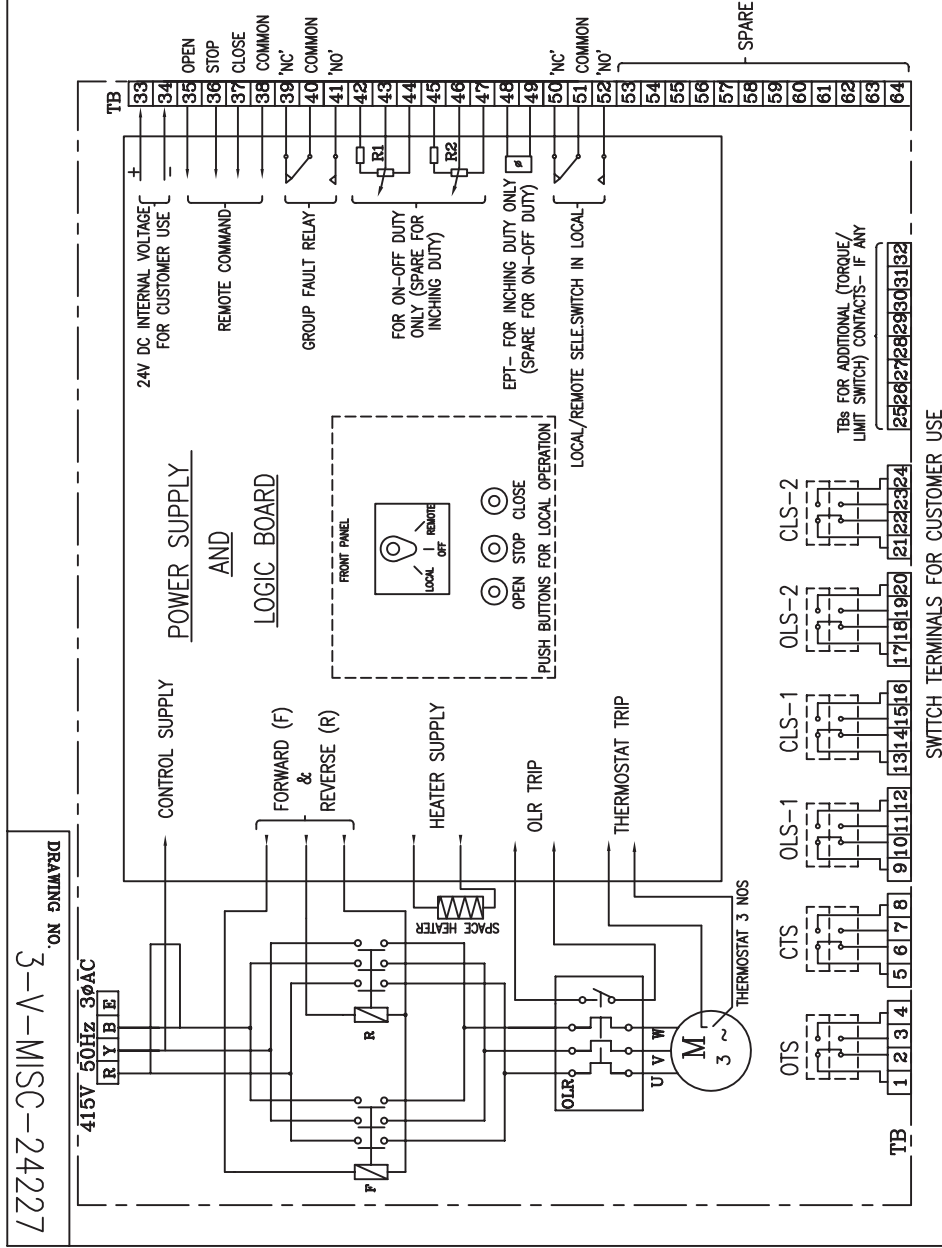
	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	SPEC NO.: PE-TS-410-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 10.03.2015
		SHEET	OF

Actuator Data Sheet

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 06.01.2015
			SHEET	1	OF
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
GENERAL *	* PROJECT	1 X 800 MW KOTHAGUDAM 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			

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 06.01.2015
			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 ☐ PROFI-BUS ☐ 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 INTRFACE 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			

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 06.01.2015
			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	$\pm 1\%$ FS			
SPACE HEATER	@SPACE HEATER	REQUIRED			
	@ POWER SUPPLY (NON INTEGRAL)	240V 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			
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☐ IP 68 @ ☐			
	@ EARTHING TERMINAL	REQUIRED			
	PLUG & SOCKET (9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	☐ REQUIRED ☒ NOT REQUIRED ☐ 2 NOS. ☐			
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----			
	@ SPACE HEATER CABLE GLAND	SIZE:-----			
	OTHER CONTROL CABLE GLANDS-1	INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PX0.5 SQMM - ONE CABLE GLAND OF OD SIZE 20 MM. INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PX0.5 SQMM AND 2ND 2PX0.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.			
	OTHER CONTROL CABLE GLANDS-2				
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.	
NOTES: SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 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 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL, WITH NICKEL COATING SHALL BE PROVIDED. - 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. - 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%. - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT 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 MPL (LEAD AGENCY). @ = TO BE FILLED BY ES					



NOTE:—

REV	DATE	ALTERED CHD & APPD
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 (Contactless , 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 3Ø 415V 50 Hz AC SUPPLY		

CONTACT DEVELOPMENT DIAGRAM

	1-2	OPEN AT OVER TORQUE	DURING OPENING TRAVEL
OTS	3-4	CLOSE AT OVER TORQUE	DURING OPENING TRAVEL
	5-6	OPEN AT OVER TORQUE	DURING CLOSING TRAVEL
CTS	7-8	CLOSE AT OVER TORQUE	DURING CLOSING TRAVEL
	9-10		
OLS-1	11-12		
	13-14		
CLS-1	15-16		
	17-18		
OLS-2	19-20		
	21-22		
CLS-2	23-24		
		FULL OPEN	a
		INTERMEDIATE	b
SWITCH	TERMINAL NO.	VALVE POSITION	
		FULL CLOSE	c

— INDICATES CONTACT CLOSED
- - - INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH					
VALVES	OPEN		CLOSE		
	MAIN	BACK UP	MAIN	BACK UP	
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS	
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS		#

– CLS NOT TO BE CONNECTED IN TRIP CIRCUIT
 * – BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)

**TYPE OF PRODUCT
OR NAME OF**

		BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.			DRN CHD APPD	NAME N.P.ESWAR D.DINAKARAN K.ARUNACHALAM	SIGN N.P D.D K.A	DATE 07.10.04 07.10.04 07.10.04	NO OF VAR.	
DEPT CODE	VL 365-121	SCALE 	WEIGHT (KG).		REFERENCE INFORMATIONS					NO. OF ITEMS
TITLE		WIRING DIAGRAM (TERMINAL PLAN)			CARD CODE		DRAWING NO.		REV	
		FOR ACTUATOR WITH INTEGRAL STARTER			U 01		3-V-MISC-24227		0	

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to or to the interest of the company.

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM		SPEC NO.: PE-TS-410-145-I	
			VOLUME	
			SECTION	
			REV. NO.	00
			DATE : 10.03.2015	
		SHEET		OF

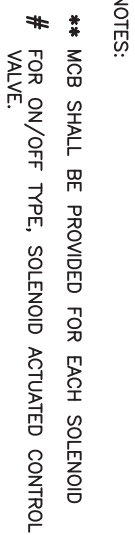
Drive Control Philosophy



Loss of Power supply (1 Phase/3 Phase)/
Loss of control supply/ Motor thermostat trip/
Thermal over load/Torque oppr/loss gnt off mode/
Local/Off/Remote Sel. switch
Stop PB opt.

Page 531 of 630

Page 532 of 630

Page 533 of 630

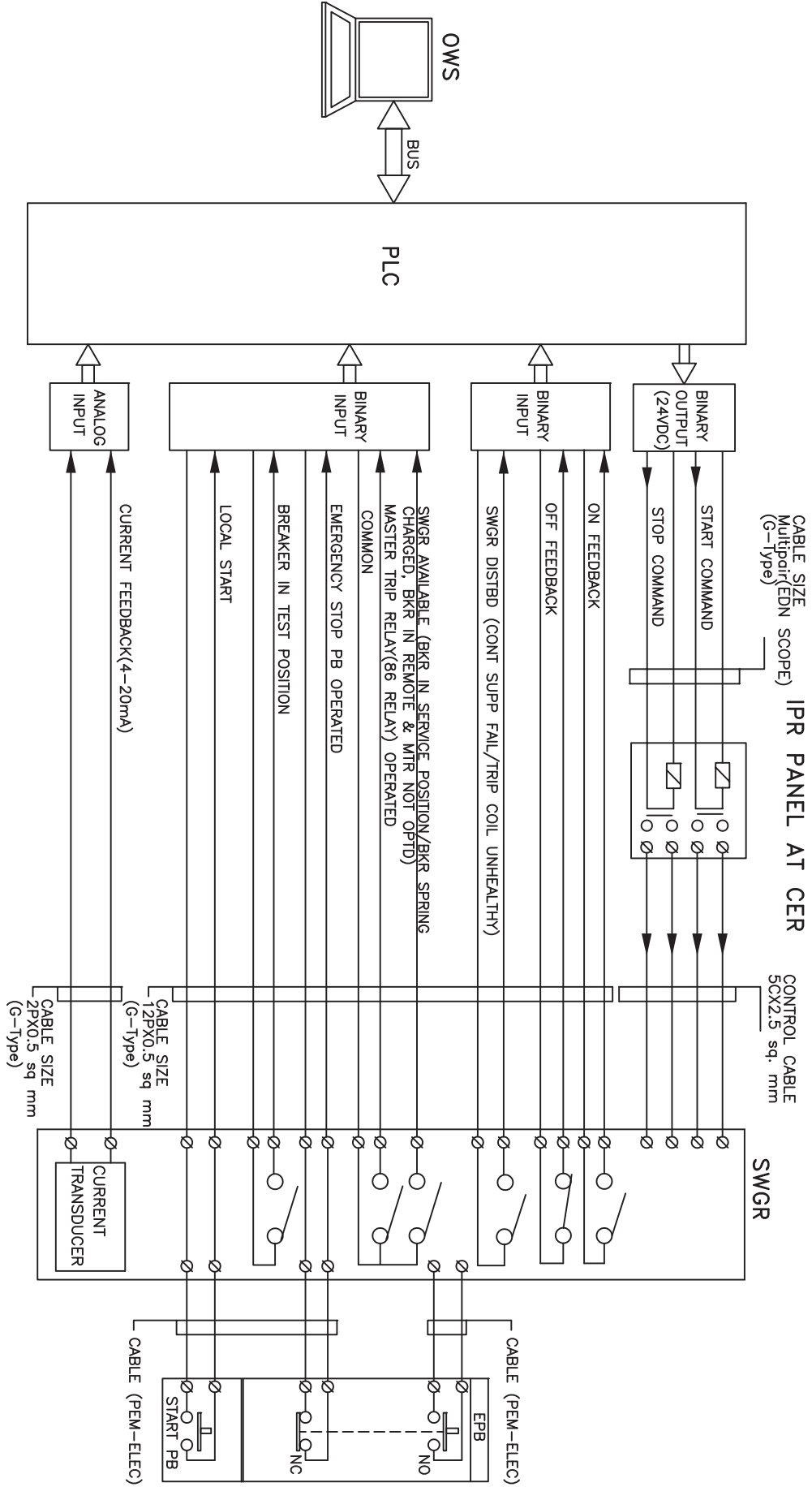


**** MCB SHALL BE PROVIDED FOR EACH SOLENOID # FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.**



महाराष्ट्र साहित्य अकादमी
Maharashtra Sahitya Akademi

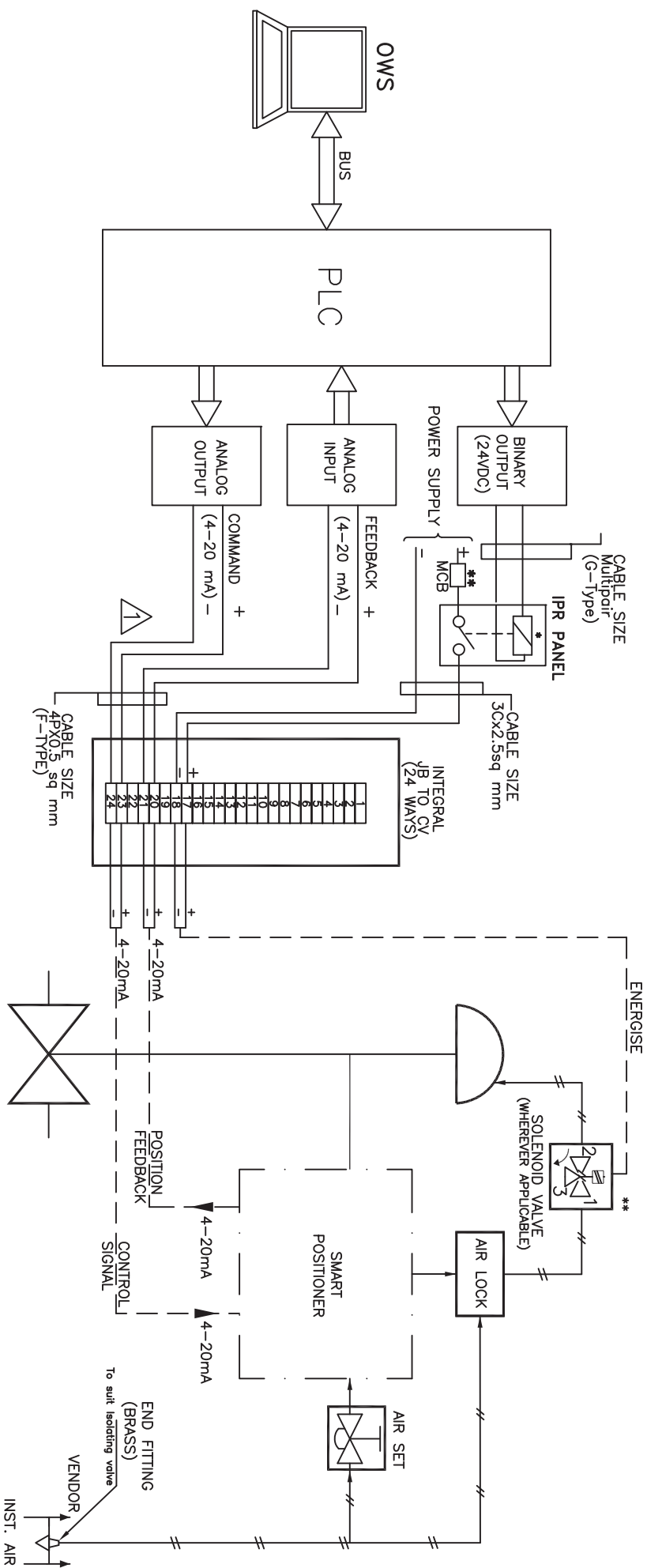
PLC INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



PROJECT:		1X800 KOTHAGUDEM TPS		DRG.NO. PE-DM-410-145-1002	
TITLE:		STAGE-VII, UNIT-12		DATE 12.03.2015	
PLC INTERFACE FOR		UNIDIRECTIONAL HT DRIVE		REV.NO. 00	
SHT		10		OF 11	



PLC INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



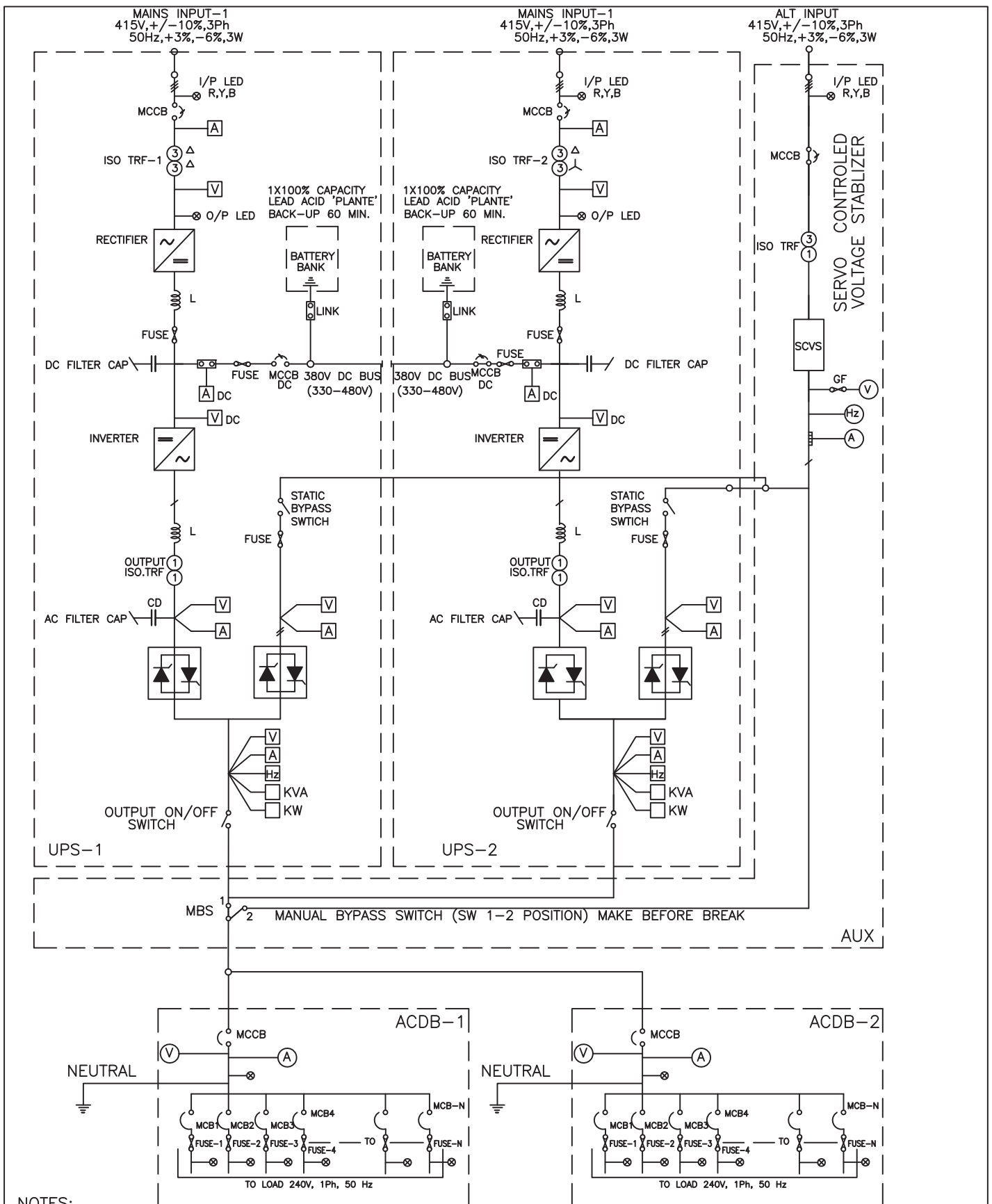
NOTES:

- ** APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.

	PROJECT: 1X800 KOTHAGUDEM TPS STAGE-VII, UNIT-12 TITLE: TYPICAL HOOK-UP DIAGRAM ANALOG DRIVE (WITH SMART POSITIONER)	DRG. NO. PE-DM-410-145-1002 DATE 12.03.2015 REV. NO. 00 SHT 11 OF 11

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	SPEC NO.: PE-TS-410-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 10.03.2015
		SHEET	OF

UPS SCHEME



1 X 800 MW KOTHAGUDEM TPS

TITLE:—

UPS SINGLE LINE DIAGRAM

DRG.
No.

PE-DG-410-145-I004

REV.
No.

00

DATE

04.02.2015

SHEET

2

OF

2

	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	SPEC NO.: PE-TS-410-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 10.03.2015
		SHEET	OF

INSTRUMENTATION DATA SHEET

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

1.00.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

1.01.00 PRESSURE TRANSMITTER

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

-
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	:	a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts c. Siphon for steam and hot water services d. ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock e. Companion flange with nuts, bolts and gaskets f. ½" NPT cable gland g. Handheld calibrator
-
19.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator/ HART management system

Notes: For primary air/ secondary air/ flue gas applications, DP type transmitters shall be provided for pressure measurement.
LVDT type is not acceptable.

1.02.00 DIFFERENTIAL PRESSURE TRANSMITTER / FLOW TRANSMITTER

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 °C
16.	Performance:		
	i. Accuracy	:	± 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	:	a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- c. Siphon for steam and hot water services
- d. ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock
- e. Companion flange with nuts, bolts and gaskets
- f. ½" NPT cable gland
- g. Handheld calibrator

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

1.03.00 Displacer Type Level Transmitters

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

	26. Applications	:	During detail engineering on Owner's approval
1.04.00	MASS FLOW METER		
1.04.01	SENSOR		
	1. Measuring Principle	:	Coriolis Mass flow
	2. Primary Element	:	Flow Tube of 316SS or better
	3. Heating Arrangement	:	Integral
	4. Temperature Control	:	For heavy fuel oil application
	5. Process Connection	:	Flanged of rating as per process requirement
	6. Drain	:	Self-draining facility
	7. Enclosure	:	Stainless steel
	8. Accessories	:	Counter flanges, Mounting nuts, bolts, gaskets etc.
1.04.02	TRANSMITTER		
	1. Measured quantities	:	Mass Flow rate, Total Mass Flow, Density
	2. Input Signal Processing	:	Smart (HART compatible)
	3. Display	:	LCD
	4. Output	:	2 nos. isolated output of 4-20mA DC selectable from four measured quantities
	5. Load	:	< 750 ohms
	6. Power supply	:	240V AC, 50 Hz

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

7.	Turn Down	:	100:1
8.	Accuracy	:	± 0.2 % of measured value
9.	Housing	:	IP 65 (Explosion proof)
10.	Nameplate	:	Tag number, service engraved in stainless steel tag plate
11.	Accessories	:	a) Handheld calibrator b) Mounting U-bolts, nuts, bolts, prefab cable etc c) $\frac{1}{2}$ "NPT cable gland
12.	Adjustment/Calibration/ /Maintenance	:	From handheld calibrator/ HART management system
13.	Applications	:	Fuel Oil service

1.05.00 RADAR TYPE LEVEL MEASUREMENT

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

		alloy	
10.	Antenna / Flange assembly	:	316 SS or Hest alloy (as required)
11.	Power supply	:	24 V DC
12.	Output Indicator	:	LCD
13.	Accuracy	:	5 mm or 0.1% of probe length
14.	Accessories	:	a) Handheld calibrator
		:	b) Counter Flange, nuts, bolts, gaskets etc
		:	c) ½"NPT cable gland
		:	d) SS Nameplate
15.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator/ HART management system
16.	Applications	:	Vessels under vacuum or low pressure applications, solid levels
1.06.00	ULTRASONIC LEVEL TRANSMITTER		
1.	Type	:	Microprocessor based, 2-wire, Smart (HART Compatible)
2.	Operating Principle	:	Detection of reflected ultrasonic pulse
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Operating frequency	:	10 KHz to 50 KHz (typical)
5.	Display	:	LCD
6.	Temperature Compensation	:	Built in –Programmable
7.	Power supply	:	24 V DC
8.	Enclosure	:	SS, IP-65 (Explosion proof for NEC Class-1, Division 1 area)

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**
1.07.00 ULTRASONIC FLOW TRANSMITTER

1.	Type	:	Ultrasonic – Clamp On										
2.	Accuracy	:	+/- 1 % of reading										
3.	Repeatability	:	+/- 0.3 % of reading										
4.	Rangeability	:	400 : 1										
5.	Output Signal	:	4-20 mA DC with HART										
6.	Measured Parameter	:	Volumetric flow, Totalized flow and flow Velocity										
7.	Display	:	LCD with internal Key Pad (Flow rate & Totalization)										
8.	Power Supply	:	24 V DC (2 Wire)										
9.	Enclosure	:	SS (IP- 68 – Submersible)										
10.	Mounting	:	SS Chain or Strap										
11.	Accessories		<table border="0"> <tr> <td style="vertical-align: top;">1.</td> <td style="vertical-align: top;">Handheld calibrator</td> </tr> <tr> <td style="vertical-align: top;">2.</td> <td style="vertical-align: top;">½"NPT cable gland</td> </tr> <tr> <td style="vertical-align: top;">3.</td> <td style="vertical-align: top;">Transducer cable</td> </tr> <tr> <td style="vertical-align: top;">4.</td> <td style="vertical-align: top;">All mounting hardware (SS-316)</td> </tr> <tr> <td style="vertical-align: top;">5.</td> <td style="vertical-align: top;">SS Nameplate</td> </tr> </table>	1.	Handheld calibrator	2.	½"NPT cable gland	3.	Transducer cable	4.	All mounting hardware (SS-316)	5.	SS Nameplate
1.	Handheld calibrator												
2.	½"NPT cable gland												
3.	Transducer cable												
4.	All mounting hardware (SS-316)												
5.	SS Nameplate												
12.	Adjustment/Calibration/ /Maintenance	:	From handheld calibrator/ HART management system										
13.	Applications	:	Plant water service										

Note: Multi-path insertion type (minimum 4 path) Ultrasonic Flow meter shall be provided for Raw water/ Cooling Water flow measurements.

2.00.00 HART HAND HELD CALIBRATOR

Hand held calibrators (5 nos. for each type) shall be provided for adjustment/ calibration/maintenance of the HART compatible

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

3.00.00 PROCESS ACTUATED SWITCHES
3.01.00 PRESSURE SWITCH

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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

3.02.00 DIFFERENTIAL PRESSURE SWITCH

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

approval

3.03.00 LEVEL SWITCH

3.03.01 FLOAT OPERATED

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

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

3.04.00 FLOW SWITCH

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

3.05.00 RF LEVEL SWITCH

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

-
1. Type	:	RADIO FREQUENCY
Sensing probe		
2. Material	:	SS-316
3. Mounting	:	Threaded
Application		
4. Temperature	:	250°C (Max.)
Electronic Controller		
5. Input Supply Voltage	:	240V AC $\pm$ 10%, 50 Hz.
6. Relay Output	:	2 SPDT (240V AC, 5A)
7. Ambient Temperature	:	50 °C
8. Enclosure Protection	:	IP-66
9. Enclosure Housing	:	SS
		Normal Level
		Power On
10. Local LED Indication	:	Alarm Level
		Probe Healthy
11. Switching Repeatability	:	$\pm$ 0.5%
		Co-axial cable for probe connection to
		controller
12. Accessories	:	SS Tag plate
		½" NPT Cable Glands
13. Application	:	Solid level

3.06.00 CONDUCTIVITY TYPE LEVEL SWITCH

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

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

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

3.07.00 TEMPERATURE SWITCH

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

-
5.	Movement Material	:	Stainless Steel
6.	Case material	:	Stainless Steel with neoprene gasket and clear glass where applicable cover conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
7..	Scale	:	Black graduation on white linear scale. Graduation 0-100% with red pointer for 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
4. Case Material	:	Stainless steel. IP-65 (Explosion proof for NEC Class-1, Division 1 area)
5. Dial Size	:	Generally 150 mm
6. Scale	:	Black lettering on white in 270 O arc.
7. Window	:	Shatterproof glass
8. Range Selection	:	Normal process pressure: 50~70 % of range
9. Over-range Protection	:	125% of maximum range by internal stop. External stop at zero
10. Adjustment	:	For Zero adjustment (Micrometer screw external) For Range adjustment (Micrometer screw internal).
11. Element Connection	:	Argon welding
12. Process Connection	:	1/2" NPT (M) Bottom for local, back for panel mounting
13. Performance	:	Accuracy of ± 1.0 % of span or better
14. Operating ambient	:	0 - 50 °C
15. Safety Feature	:	Blow out disc /diaphragm at the back
16. Accessories	:	a) Snubbers for pulsating fluid application.discharge b) Stainless steel Diaphragm seals

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

for corrosive/ viscous/ solid
bearing or slurry type fluid
applications

c) 3-Way SS316 Gauge cock for
pressure gauges

d) 5-valve SS316 manifold from
barstock for differential pressure
gauge

e) Siphons for steam and hot
water services

17. Nameplate : Tag number, service engraved in
stainless steel tag plate

4.02.00 LEVEL INDICATOR (FLOAT & BOARD TYPE)

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

gasket etc. as applicable, SS Tag plate

4.03.00 GAUGE GLASS

1. Type : Reflex /Transparent
2. Material :
 Glass : Toughened borosilicate resistant to thermal shock
 Body Material : ~~Carbon Steel~~ Stainless Steel
 Enclosure : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
3. Integral cocks & valves/Fittings :
 i. SS 316
 ii. Rubber lined corrosion resistant
4. :
 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
 For larger lengths (greater than 1200mm), additional gauge glasses
9. Other details : shall be provided with minimum of 50 mm overlap.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

-
- 4.04.00 SLIGHT GLASS
1. Type : Flap-type.
 2. End connection : Screwed / Flanged
 3. Material
 - a) Body : SS- 304
 - b) Cover plate : SS- 304
 - c) Indicator : SS- 316
 4. Sight Glass : Toughened Borosilicate
 5. Gasket : Neoprene
 6. Bolts & Nuts : High tensile steel.
 7. Hydraulic Test Pressure : 1.5 times maximum working pressure
 8. Accessories : Companion Flanges, Bolts, nuts, gaskets as required, SS Tag plate.
- 4.05.00 ROTAMETER
1. Type : ON-LINE for line upto and including 50 mm NB.
: Borosilicate BY-PASS for line size above 50 NB
 2. Metering tube : Toughened Borosilicate
 3. Float : SS-316
 4. End fittings : SS-316
 5. Packing material : Teflon / PTFE
 6. Casing : Stainless Steel
 7. Gland Rings : Stainless Steel
/Followers/ Other wetted parts
 8. Orifice Plate : Stainless Steel (for bypass type)
 9. Operating Temperature : 0-50 Deg. c

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

10. Test Pressure	:	200% of maximum operating pressure
11. Scale	:	250 mm nominal length
12. Graduation	:	Direct reading
13. Process Connection	:	Flanged (RF) to line size as per ANSI standards (150#)
14. Tapping	:	D & D/2
15. Accuracy	:	+/- 2% of full scale reading
16. Reproducibility	:	Within 0.5% of instantaneous reading
17. Accessories	:	SS Tag Plate, orifice plate

5.00.00 TEMPERATURE ELEMENTS & ACCESSORIES
5.01.00 RESISTANCE TEMPERATURE DETECTOR

1. Type	:	Platinum (Duplex), Ungrounded
2. Platinum (Duplex), Ungrounded	:	100 ohm at 0 °C
3. Base	:	Wound on ceramic (anti-inductive)
4. Wiring	:	3 Wire
5. Protecting Tube		
a) O.D.	:	6 mm
b) Material	:	SS-316, Seamless
c) Filling	:	Magnesium oxide (Purity above 99.4%).
6. Response time	:	a) 15 sec. (bare). b) 30 sec. (with thermowell)
7. Calibration	:	DIN 43760
8. Accuracy	:	± 0.5%
9. Head		
a) Type	:	IP-65 universal screwed type

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- b) Material : Stainless Steel
- c) Terminal blocks : Nickel plated Brass-screw type / silver plated
- d) Cable connection : ½" NPT gland and grommet
- e) Others : Terminal head cover with SS chain and suitable gasket.

Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable).

- Adjustable nipple-union-nipple [1/2" Sch 80 X ½" NPT] with thermowell connection
- 10. Accessories :
 - a)
 - b) Compression fittings/unions
 - Flanges etc. (for flanged connections only)
 - c)
 - Thermowell (As specified below)
 - d)
- 11. Thermowell connection : ½" NPT (M) or 150 RF Flanged
- Tag number, service engraved in
- 12. Nameplate : stainless steel tag plate

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

Note: The specifications for RTDs of winding/ bearing of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However, the type of RTD shall be Pt-100.

5.02.00 THERMOCOUPLES

1. Type :
 - a) 16 SWG wire of Chromel Alumel) (Type-K)
 - b) Duplex
 - c) Ungrounded
2. Protecting Tube
 - a) O.D. : 6 mm
 - b) Material : SS-316, Seamless
 - c) Filling : Magnesium oxide (Purity above 99.4%).
3. Response time :
 - a) < 20 seconds for measurement
 - b) < 10 seconds for control
4. Accuracy : $\pm 1.1^{\circ}\text{C}$ up to 300°C & 0.4% of measured temperature range above 300°C
5. Head
 - a) Type : IP-65 universal screwed type
 - b) Material : Stainless Steel
 - c) Terminal blocks : Nickel plated Brass-screw type / silver plated
 - d) Cable connection : $\frac{1}{2}$ " NPT gland and grommet
 - e) Others : Terminal head cover with SS chain and suitable gasket.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable).

7.	Accessories	:	a) Adjustable nipple-union-nipple [1/2" Sch 80 X 1/2" NPT] with thermowell connection b) Compression fittings/unions c) Flanges etc. (for flanged connections only) d) Thermowell (As specified below)
8.	Thermowell connection	:	1/2" NPT (M) or 150 RF Flanged
9.	Nameplate	:	Tag number, service engraved in stainless steel tag plate

5.03.00 TEMPERATURE GAUGE

1.	Type	:	Expansion type (Liquid filled system)
2.	Sensing Element Material	:	Bourdon – SS-316
3.	Bulb and Capillary Material	:	SS-316
4.	Capillary Tubing	:	Inner sheath - solid drawn Material copper tube Outer sheath - PVC tube
5.	Movement Materials	:	Stainless Steel / Direct Bourdon tip connection to pointer spindle
6.	Case Material	:	Stainless Steel stove enameled, black finish, threaded bezel ring, clear glass

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

		cover conforming to IP 65.
7.	Dial size	: 150 mm
8.	Scale	: Black lettering on white background in 270 Deg.C arc
9.	Over range protection	: 125 percent of FSD
10.	Capillary Glanding	: 1/2" NPT(M) x compression fitting (SS) to suit capillary
11.	Instrument Connection	: Bottom connection for local mounting, back connection for panel mounting
12.	Process Connection	: 1/2" NPT (M) or 150 RF Flanged
13.	Extension Neck Length	: 50 mm
14.	Compensation	: a) Capillary compensation
15.		: b) Case compensation
16.	Performance	: a) Accuracy : + /- 1.0 percent of full scale Deflection
		: b) Repeatability : Less than 0.5 percent of full range
		: c) Response time: 15 seconds (max.).
17.	Capillary length	: 3.0 meters (local) / 15.0 metres (local panel)
18.	Other features	: Shatter proof glass
19.	Nameplate	: Tag number, service engraved in stainless steel tag plate
20.	Accessories	: SS316 Thermowell
5.04.00	THERMOWELL	
1.	Material	: SS-316
2.	Manufacture	: Drilled from bar stock, Hex Head, Tapered design (As per ASME PTC 19.3)

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

3.	Process connection	:	M33x2
4.	Certification	:	Not applicable
5.	Bore concentricity	:	+5% of wall thickness
6.	Identification mark	:	Tag number punched on head
7.	Surface treatment	:	Polish after machining
8.	Element connection	:	½" NPT (M) or 150 RF Flanged
9.	Head	:	Hex
10.	Length of the hex head	:	31.75 mm (min.)
11.	Accessories	:	SS Plug and chain for test thermo wells SS Nameplate, Flange with companion flange & all required accessories for flanged connections.

Note: Wake frequency calculations shall be furnished for all thermowells for approval.

Thermowells shall be designed such that the resonant frequency is above the exciting frequencies generated by vortex shedding in the process fluid.

5.05.00 METAL TEMPERATURE THERMOCOUPLE

1.	Measuring medium	:	Metal temperature
2.	Type	:	Chromel Alumel (Type-K) Duplex, Ungrounded
3.	Insulation	:	Mineral Insulation Magnesium Oxide
4.	Wire gauge	:	16 AWG
5.	Protective sheath	:	SS
6.	Protective sheath diameter	:	8 mm O.D.
7.	Characteristics	:	Special limits of error as in ANSI thermocouple MC 96.01
8.	Accessories	:	½" BSP SS sliding end connector, weld pad, clamps of heat resistant steel

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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

9.06.00 DENSITY/ CONCENTRATION METER

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

10.00.00 SOLENOID VALVES

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

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

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION	
	1X800 MW KOTHAGUEDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
	REV. NO. 00	DATE : 10.03.2015
	SHEET OF	

Instrumentation Quality Plan



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

CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	1.1 MODEL NO/TAG NO						
	1.2 RANGE						
	1.3 END CONN						
	1.4 NO. OF CONTACT						
2	CALIBRATION			P	V	V	
	2.1 REPEATABILITY						
	2.2 SET POINT ADJUSTMENT						
	2.3 DIFFERENTIAL						
3	OVER PR & LEAK TEST				P	V	V
4	ELECT. INSULATION/HV TEST	ONE		P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT		V	V	V	
	5.1 SENSOR						
	5.2 MOVEMENT						
	5.3 PROCESS CONNECTION						
	5.4 HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V	

** 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 carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL

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

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	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST			P	W	V	
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V	
5	REVIEW OF TC FOR	FOR LOT		V	V	V	
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
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	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC 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.

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

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			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.

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION	
	1X800 MW KOTHAGUDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
	REV. NO. 00	DATE : 10.03.2015
	SHEET OF	

LCP and JUNCTION BOXES SPECIFICATION

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 1.00.00 **GENERAL REQUIREMENT**
- 1.01.00 ENCLOSURES FOR INSTRUMENTS AND OTHER EQUIPMENT
- 1.01.01 All panels, cabinets, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall have suitable environmental protection as detailed in Section-I of this volume of the specification.
- 1.02.00 SURFACE PREPARATION & PAINTING
- 1.02.01 All sheet metal panel/ desk exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below.
- 1.02.02 Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale and all other residue due to the fabrication operation. Oil, grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods prior to blasting.
- 1.02.03 Two spray coats of inhibitive epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:
- Exterior – Opaline green shade 275 of IS: 5 or equivalent international code..
 - Interior - Brilliant White.
- 1.02.04 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections, shall not be acceptable.
- 1.03.00 WIRING
- 1.03.01 All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. All intercommunications between sections of panels/desks shall be furnished.
- 1.03.02 Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized ink print shall be used with cross- identification.
- 1.03.03 All wire termination shall be made with insulated sleeve and crimping type lugs. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

**Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS**
**EPC Bid Document
e-PCT/TS/K/02/2014-15**

- 1.03.04 Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. Internal wiring shall be grouped so that all outgoing wiring to each particular remote location is terminated on adjacent terminal blocks. Interior wiring and jumperings shall be arranged so that external connections can be made from internal side of terminal blocks. Common connections shall be limited to two (2) wires per terminal.
- 1.03.05 Wiring shall be arranged to ensure free access to all instrument or devices for maintenance. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices
- 1.03.06 Wires shall be dressed and run in trays or troughs with clamp-on type covers. Wirings may be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.
- 1.03.07 Shield wires shall be terminated on separate terminal blocks. Common connections shall be limited to two wires per terminal. Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturer.
- 1.03.08 All low level signal cables shall be separately bundled to from control cable and maintained at 300 mm minimum spacing from control bundles.
- 1.03.09 Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.
- 1.03.10 Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. Shielded wires used in such cases for panel internal wiring shall be continuous and ungrounded with the shield terminated individually and separately in panel terminal block.
- 1.03.11 Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue failure of the conductor.
- 1.03.12 Internal wiring in factory pre-wired electronic systems cabinets may be installed according to the Contractor's standard wire size, insulation, and method of termination on internal equipment. Insulation for all wiring, including circuit board wiring, back panel wiring, power supply wiring and interconnecting cables between devices shall pass the vertical flame test per IPCEAS-1981. Identification of conductors may be done by insulation color-coding identified on drawings or by printed wiring lists.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 1.04.00 TERMINAL BLOCKS
- 1.04.01 All terminal blocks shall be rail mounted/ post mounted type, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 Deg C. The terminal blocks in field mounted junction boxes, instrument enclosures racks etc. shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room termination/ marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by Bidder shall be subject to Owner.
- 1.04.02 All terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, small partitions, transparent covers, support brackets, distance sleeves, warning level, marking etc. For RTDs ring - tong type lugs shall be used at Junction Boxes.
- 1.04.03 The characteristics of the terminal blocks shall be as follows.
- i) High contact force, independent of conductor cross-section and large contact surface area.
 - ii) Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.
 - iii) Inspection and maintenance free (resistant to thermal aging and vibration)
 - iv) Low and constant voltage drop
- 1.04.04 The insulation of the terminal blocks shall be of suitable thermoplastic material.
- 1.04.05 The spacing between Terminal blocks channels in panels and cubicles shall be adequate for routing the cable troughs and to allow adequate free workspace for termination and removal of wires. The terminal blocks shall be arranged with atleast 100 mm clearance between two sets of terminal blocks and junction box walls.
- 1.04.06 Signals of different voltage levels shall be clearly segregated by providing separate rows to each type of signal and by using terminal blocks of different color for each type of signal and by providing barrier strips between them.
- 1.04.07 Terminal blocks shall be provided with white marking strips / self-adhesive marker cards and where permitted by the safety codes and standards, shall be without covers. Power terminals and high voltage (above 48 volts) terminals shall have protection covers. All terminals shall be provided with permanent terminal identification numbers on both sides.
- 1.04.08 At least 20% spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- 1.04.09 The bottom of the terminal block shall be at least 200 mm above the cable gland for bottom entry type panels.
- 1.04.10 For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.
- 1.04.11 Other requirements of the terminal blocks are as follows:
- i) The last terminal in a rail-mounted assembly shall be closed with an end plate and end bracket.
 - ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.
 - iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.
 - iv) It shall be possible to use jumper plugs through the above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.
 - v) Where more than one connection to a terminal block is required, two tier terminals shall be used.
- 1.05.00 **GROUNDING**
- 1.05.01 Separate Protective and Electronic system ground as required shall be provided.
- 1.05.02 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus (Frame ground), bolted to the panel structure at bottom on both sides and effectively ground the entire structure. The bolts shall face inside of panels.
- 1.05.03 For electronic system cabinets the electronic system ground bus (Electronic ground) shall be similar but insulated from the cabinet and shall be separately connected to the system ground. The same ground may be used to earth the shield of shielded signal cables, otherwise a separate ground bus shall be provided for connecting the signal cable shields. Cable shields shall be grounded at the panel end only and shall never be left open. The electronic ground between panels of a shipping section shall be firmly looped.
- 2.00.00 **CONTROL DESKS & PANELS**
- 2.01.00 **GENERAL**
- 2.01.01 All control desk, panels etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, utility receptacles, grounding, ventilation, space heating, anti-vibration pads, internal piping &

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- accessories as required for completeness of the system.
- 2.01.02 The design shall conform to the EN ISO 11064 (Ergonomical design of Control Room), Part 1, 2 and 3.
- 2.01.03 The exact dimensions, material, construction details, grounding, general arrangement etc. shall be as per actual requirement and shall be finalized during detail engineering and subjected to Owner's approval.
- 2.01.04 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.
- 2.01.05 For Control desk/ panel mounted instruments/ devices etc. which are to be powered from UPS, all required conversion of interface equipments/ accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS redundant feeders shall be provided with suitably rated MCB and provision of fast auto changeover of UPS feeders.
- 2.01.06 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- 2.01.07 Nameplate
- a) Nameplate shall be provided for instrument or device mounted on the panel.
 - b) Nameplates for panels shall be provided both in front and rear.
- 2.02.00 CONTROL DESK
- 2.02.01 Control desk shall be free standing, floor mounting, table top type with doors at back and shall be constructed of 3 mm thick (minimum) CRCA steel or Aluminium extrusion. Aluminium structure shall be anodized or powder coated paint finish. The top surface of control desk shall be 30 mm (minimum) thick with the top 12 mm (minimum) of acrylic solid surface and the remaining 18 mm of laminated medium density fibre (MDF) board.
- 2.02.02 Monitors with retractable keyboard shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.
- 2.02.03 Desks shall be of modular, scalable and industrially ruggedized design and shall have connections for PA system handsets & telephone sets.
- 2.02.04 Desks shall have concealed cable trays for wire dressing. Both Horizontal & Side Managers (2 separate horizontal cable routing wire baskets for power & data cables) shall be provided.

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

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

- 2.02.05 Design shall include Earthing bolts.
- 2.02.06 Back installed items shall be suitably concealed from front view.
- 2.02.07 All operator workstations for SG, TG, Auxiliaries & Off-site Plants shall be mounted on this Control Desk. The cabling / wiring between OWS & CPUs, power supply cables etc. shall be aesthetically routed and concealed from view.
- 2.02.08 **HARDWIRED DEVICES ON CONTROL DESK (DRAW OUT SECTION)**

Release and Lamp Test push buttons shall be provided for a set of push buttons (decided during detail engineering stage). Depending on the type of control/ function, required number of push buttons/ indicating LEDs & their color, push button stations shall be selected. The size of push button stations shall be 24 x 48 mm or 25 x 50 mm and shall have service inscription details at the front. Emergency push buttons (with cover) shall be mounted on top of Control Desk.
- 2.03.00 **BACK UP PANEL**
- 2.03.01 Construction shall be from CRCA steel of thickness not less than 3mm.
- 2.03.02 Upright back-up panel shall be provided where hardwired devices shall be mounted on a mosaic grid type console. The mosaic grid tiles shall be of 24 mm x 48 mm (or 25 mm x 50 mm) size, made of heat & flame retardant, self extinguishing and non-hygroscopic material with flat matt finish without glare and non reflecting type.
- 2.03.03 DDCMIS Back-up Panel (referred as Unit Control Panel-UCP) shall also mount annunciation fascia (minimum 500 nos.) and the flame monitoring cameras along with other hardwired devices as decided during detail engineering stage by Owner. Color coding shall also subject to Owner's approval.
- 2.03.04 Colored Mimic for different Off-site plant control systems (as enumerated elsewhere in this specification) and hardwired annunciation system shall also

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

be mounted on the back up panels.

2.04.00 PANELS/CABINETS

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

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

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

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

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

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

2.04.07 TECHNICAL PARTICULARS

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

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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

tightness between kick plate and finished floor

f) Lifting hook / Eye bolt

g) Drawing pocket

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

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

2.05.00 FURNITURE

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

2.05.01 WORK STATION FURNITURE

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

2.05.02 PC RACK

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

2.05.03 CHAIRS

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

EPC Bid Document
e-PCT/TS/K/02/2014-15

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.

2.05.05 ALMIRAHs

Steel Almirahs shall be provided for keeping documents in the documentation room. Glass doors for each rack shall be provided such that the documents are visible from outside. Size of the rack shall be sufficient to easily fit technical manuals. The exact details shall be approved by Owner during detailed Engineering.

2.05.06 KEYPAD

One keypad per unit shall be provided for the storing of keys of relevant areas of the unit in the control room.

2.05.07 LOCKERS

Suitable lockers shall be provided in the room adjacent to the control room for storing of personal articles of control room personnel. Also, lockers of bigger size shall be provided in documentation Room for storing of personal documents. Details shall be finalized and approved by Employer during detailed engineering.

3.00.00 **LVS PANEL**

3.01.00 An arc shaped Large Video Screen (LVS) panel shall be supplied for mounting large video screens in number of tiers in various Control rooms as specified elsewhere in this specification.

Bidder shall provide and fix ACP cladding around the LVS screen including covering the LVS back side and LVS stand. The cladding will be from floor finish to 600 mm above LVS screen like a self-standing partition with necessary openings for system requirement. ACP paneling shall be with 304 grade & approx. 0.5 mm mirror finish SS strip.

3.02.00 The profile, dimensions and the general arrangement shall be finalized & approved by Owner during detailed engineering. Recommendations, if any, for the control room lighting in order to ensure continuous proper viewing of the LVS screen by the operator & shift incharge (without any fatigue) shall be

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- clearly brought out by the Contractor in his offer, alongwith all relevant details/basis.
- 3.03.00 Any other requirement for proper LVS mounting & functioning & viewing shall also be specifically brought out by the Contractor in his offer, along with all relevant details.
- 4.00.00 **LOCAL INSTRUMENT RACK (LIR) & LOCAL INSTRUMENT ENCLOSURE (LIE)**
- 4.01.00 GENERAL
- 4.01.01 Devices (Transmitters/ Switches) located in the field shall be suitably grouped together to the extent possible and installed in the LIE (Closed Rack) and LIR (Open Rack) in Boiler/TG Building and Off-site plant areas.
- 4.01.02 Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.
- 4.01.03 No more than six instruments shall be grouped in a single rack / enclosure.
- 4.01.04 Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.
- 4.01.05 Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air /gas piping.
- 4.01.06 Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging
- 4.01.07 Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.
- 4.01.08 Earth stud shall be furnished at rack for safety grounding.
- 4.02.00 **LOCAL INSTRUMENT ENCLOSURE (LIE)**
- 4.02.01 Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load - bearing posts shall be suitably supported by gusset plates or moment members.
- 4.02.02 Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.
- 4.02.03 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

- member, which would reduce access, shall be avoided.
- 4.02.04 Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.
- 4.02.05 Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box. All enclosures shall have access doors on front side.
- 4.02.06 Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.
- 4.02.07 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings within transmitter racks both open and closed type, is admissible.
- 4.02.08 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..
- 4.02.09 Each rack shall be provided with one receptacle, light fixtures with wire guard and one lighting switch each at instrument & Junction box compartments with wire guard. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.
- 4.02.10 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.
- 4.02.11 Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations
- 4.03.00 LOCAL INSTRUMENT RACK (LIR)
- 4.03.01 Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS
EPC Bid Document
e-PCT/TS/K/02/2014-15

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

- 4.03.02 Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable fenders grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project to protect instrument from accidental contact during personnel movement. Center posts or any member, which would reduce access, shall be avoided.
- 4.03.03 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.
- 4.03.04 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.
- 4.03.05 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

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

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

4.04.00 JUNCTION BOX

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

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

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001 DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
TAG No. Qty.....		SHEET 1 OF 3		
Data Sheet No.: PES-145A-DS1-0				
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER			
	CONSTRUCTION		☒ FOLDED ☐ WELDED	
	ENCLOSURE SHEET THICKNESS (As per Section 8.13, Volume V of contract specification)	FRONT	☐ 2.0 mm	
		OTHER	☐ 2.0 mm	
		DOOR	☐ 1.6 mm	
		HEIGHT	☐ 2365 mm for stand alone panels. ☐ Other	
	OTHER	☐ Load bearing sheet front shall have 3mm thickness		
TECHNICAL	INPUT POWER SUPPLY * (As per Electrical specification) (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE 3W ☐ 400V 3 PHASE 4W	
	NO. OF FEEDERS (As per Electrical specification)		☐ ONE ☐ TWO	
	STARTER WITH MCC		☐ REQUIRED ☒ NOT REQUIRED	
	IPR POSITION		☒ MCC ☐ RELAY PANEL	
	CONTACT RATING OF RELAY		☒ 5 Amp, 230 V AC ☒ 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		____ NOS. (AS REQUIRED)	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ☒ NOT REQUIRED	
	PAINT TYPE (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ EPOXY ENAMEL ☐ EPOXY POWDER COATED	
	MIMIC (TYPE OF MIMIC- MATERIAL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☒ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ LIGHT GREY ☐ OPALINE GREEN	
	FINISH (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ WHITE ☐ CREAM ☐ OFF WHITE	
	FINISH (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	CLASS OF PROTECTION		☒ IP-55 (FOR INDOOR SERVICE) ☒ IP-67 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
	CONTROL HARDWARE		☒ RELAY BASED	
FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS		
WEIGHT OF PANEL (Kg.)		(Vendor to specify)		

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001 DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
TAG No. Qty.....		SHEET 2 OF 3		
Data Sheet No.: PES-145A-DS1-0				
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	PANEL TYPE	☐ PRESSURISED ☐ UNPRESSURISED As per Requirement		
	CABLE GLAND	☒ DOUBLE COMPRESSION		
	AMMETER (TYPE OF INPUT) *	☐ 1 Amp CT ☐ 4-20 mA		
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☒ NA		
	* TO BE CO-ORDINATED WITH PEM ELECTRICAL			
NAME DESIGNATION SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:
	AANCHAL CHOUDHARY	SACHIN SRIVASTAVA	MA MANSOORI	
	SR.ENGR	DY.MNGR	D. GM	
	16.09.2013	16.09.2013	16.09.2013	

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
			SHEET 3	OF 3
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0	
Data Sheet C				
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)				
GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
		OTHER		
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTACT RATING OF RELAY			
	TEMP SCANNER			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	TYPE OF MIMIC MATERIAL OF MIMC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.: PE-SS-999-145-054A	
				VOLUME	
				SECTION	
				REV. NO. 02	DATE: 16.09.2013
				SHEET 3 OF 3	
TAG No. Qty.....				Data Sheet No.: PES-145A-DS1-0	
Data Sheet C					
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)					
	PANEL TYPE				
	CABLE GLAND				
	AMMETER (TYPE OF INPUT)				
	SCOPE OF SUPERVISION				
NAME SIGNATURE DATE	PREPARED BY		CHECKED BY		APPROVED BY
	AANCHAL CHOUDHARY		SACHIN SRIVASTYAVA		MA MANSOORI
	16.09.2013		16.09.2013		16.09.2013
					COMPANY SEAL NAME: SIGNATURE: DATE:

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION	
	1X800 MW KOTHAGUDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
	REV. NO. 00	DATE : 10.03.2015
	SHEET OF	

LCP Quality Plan

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056			
										VOLUME IIB			
										SECTION D			
										REV. NO. 01 DATE: 22-02-2008			
										SHEET 1 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2		
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---		
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---		
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---		
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---		
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---		
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---		
		3. Straightness	MA	Measurement	100%	Factory Std. Relevant standard	Factory Std. Relevant standard	Log Book	2	---	---		
		4. Mill marking	MA	Visual	100%			Log Book	2	---	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---		
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P W V 1 - BHEL 2 - Vendor 3 - Sub-vendor			

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056							
												VOLUME IIB							
												SECTION D							
												REV. NO. 01 DATE: 22-02-2008							
												SHEET 2 OF 7							
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks							
									P	W	V								
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	---							
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	---	---	2							
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	---	+ for relay & contactors only						
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant standard & Catalogue	Relevant standard	Log Book	2	---	---	---	@ for all components except relays & contactors.						
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	---							
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	---							
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	---							
		6. Calibration	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	1							
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	---							
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics														\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			1 - BHEL 2 - Vendor 3 - Sub-vendor		

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056							
										VOLUME IIB							
										SECTION D							
										REV. NO. 01 DATE: 22-02-2008							
										SHEET 3 OF 7							
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---						
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---						
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---						
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---						
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---						
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---						
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---						
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2						
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2						
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2						
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2						
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.				1 - BHEL 2 - Vendor 3 - Sub-vendor			

 STD QUALITY PLAN NO.: PE-QP-999-145-1056		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL											
		VOLUME IIB											
		SECTION D											
		REV. NO. 01 DATE: 22-02-2008											
		SHEET 4 OF 7											
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													
P - Agency Performing the Test. 1 - BHEL W - Agency Witnessing the Test. 2 - Vendor V - Agency Verifying the Test. 3 - Sub-vendor													

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics

\$ P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

 STD QUALITY PLAN NO.: PE-QP-999-145-1056		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										VOLUME IIB SECTION D REV. NO. 01 DATE: 22-02-2008 SHEET 5 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks		
									P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1				
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---				
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1		At Random by BHEL, based on 100 % internal test reports by Mfr.		

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
												VOLUME		IIB			
												SECTION		D			
												REV. NO.		DATE: 22-02-2008			
												SHEET		6		OF	
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.					
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1						
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1						
		11. Wire Termination	MA	Pulling manually	Sample	----	Firm termination	Inspection Report	2	1	1						
		12. Continuity	MA	Electrical	100%	----	Continuity OK	Inspection Report	2	1	1						

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics

\$ P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056			
										VOLUME IIB			
										SECTION D			
										REV. NO. 01		DATE: 22-02-2008	
										SHEET 7		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1		
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1		
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1		
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1		
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1		

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION 1X800 MW KOTHAGUDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
REV. NO.	00	DATE : 10.03.2015
SHEET	OF	

PC SPECIFICATION

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for	
	Computer	
	For	
	1X800 MW Kothagudem	
SPEC NO.: PE-TS-410-145-I		
VOLUME		
SECTION		
REV. NO.	00	DATE : 07.03.2015
SHEET	OF	

SPECIFICATION FOR PC

a. CPU

1. Processor : Intel core i5 or better, 32 bit
2. RAM : 4 GB min. and expandable to 16 GB
3. Hard Drive : 500 GB or more
4. Removable bulk storage : DVD (R/RW)
5. Graphic accelerator : 8MB (minm.)
6. Graphic Memory : dedicated 1GB or better
7. Operating System : Windows 7 or better
8. Audio controller : 16 bit
9. Communication Port : 2 serial, one parallel, 8 USB, Dual 100Mbps Ethernet
10. Expansion Slot : 3
11. Cache : 512 KB Level 2
12. Video Card : PCI

b. MONITOR

1. Type : LCD COLOUR MONITOR
2. Screen Diagonal : 24" (approx.) flat
3. Display : XGA or better
4. Resolution : 1024 by 768 or better
5. Degree of Protection : IP-30
6. External Controls : Brightness, contrast, Horizontal/Vertical, amplification & Shift
7. Version : To suit Industrial application

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for	
	Computer	
	For	
	1X800 MW Kothagudem	
		SPEC NO.: PE-TS-410-145-I
		VOLUME
		SECTION
REV. NO. 00		DATE : 07.03.2015
SHEET		OF

c. KEY BOARD & MOUSE

1. Type : Flat spill proof membrane or positive depression type ASCII
2. Life Expectancy : 50 million cycles per key
3. Version : To suit Industrial application
4. Mouse : Optical mouse

d. SOFTWARE

Diagnostic Software, Anti Virus, Microsoft office, Acrobat Adobe Software and other application software.

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION	
	1X800 MW KOTHAGUEDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
	REV. NO. 00	DATE : 10.03.2015
	SHEET OF	

FURNITURE SPECIFICATION

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for	
	FURNITURE	
	For	
	1X800 MW Kothagudem	
		SPEC NO.: PE-TS-410-145-I
		VOLUME
		SECTION
REV. NO. 00		DATE : 07.03.2015
SHEET		OF

SPECIFICATION FOR FURNITURE

- a) 4 Nos. cushioned revolving, independently adjustable seat and back chairs.
- b) Glass top Teak wood / MDF table for mounting Operator Station monitors.
- c) Printer tables.
- d) Glass top Teak wood / MDT table for System Engineering Room / Engineering stations with drawer at end.
- e) Glass top teak wood / MDF table with vertical file mounting arrangement (two layer to house approx. 40 Nos of files and lockable drawers at both end) for System Engineering Room / Engineers.

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001		
	Technical specification for CONTROL & INSTRUMENTATION		
	1X800 MW KOTHAGUEDEM		
	SPEC NO.: PE-TS-410-145-I		
	VOLUME		
	SECTION		
	REV. NO.	00	DATE : 10.03.2015
	SHEET OF		

CABLE BOQ

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

	THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-410-163-A001	
	Technical specification for CONTROL & INSTRUMENTATION	
	1X800 MW KOTHAGUEDEM	
	SPEC NO.: PE-TS-410-145-I	
	VOLUME	
	SECTION	
	REV. NO. 00	DATE : 10.03.2015
	SHEET OF	

KKS PHILOSOPHY



DOCUMENT TITLE

KKS NUMBERING PHILOSOPHY

1X800MW KOTHAGUDEM

KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A A Y			Y B B B		

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
	1X800 MW KOTHAGUDEM

ANNEXURE-1**List of System / Sub-System Codes used in Power Plant:**

- 1) Compressed air system : QEA, QEC
- 2) Ventilation System : SAA TO SAZ
- 3) Fire Detection & Protection System + Fire Water pumps : SGM, SGN, SGO, SGP
- 4) Sewage Treatment : SJA TO SJZ
- 5) Pre-treatment Plant : GBI, GBM, GBV
- 6) RO DM Plant : GCI, GCM, GBV

ANNEXURE-2**Standard Equipment Codes:**

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
	1X800 MW KOTHAGUDEM

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level
CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3**Numerical Keys****A) Numerical Keys at System Code Level**

- i) Use 10, 20, 30, ... To distinguish between main systems having same Alpha Codes. Examples:
 - a) Main Steam (Left) and Main Steam (Right)
 - b) BFP – A/B/C
 - c) ID Fan – A/B, FD Fan A/B, AH – A/B
- ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.
- iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

- i) Valves and Dampers --- *Equipment Code – AA*

N1N2 N3

DOCUMENT TITLE			
	KKS NUMBERING PHILOSOPHY		
	1X800 MW KOTHAGUDEM		
Motorised (<i>on/off duty</i>)	-	0	01 to 50
Motorised (<i>inching duty</i>)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (<i>thyrestor Control</i>)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99
NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99
ii) Field Instruments			
Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			
Example of Numerical Key Usage:			
In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, ... Where system code is same.			



TITLE:

TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME: II-B

SECTION: D4

REV NO: 00

DATE:

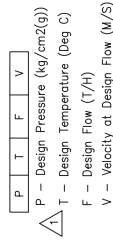
SECTION – D4 DRAWINGS

1. DESIGN PRESSURE FOR DM TRANSFER PUMP DISCHARGE PIPING SHALL BE CORRESPONDING TO SHUT OFF HEAD OF THE PUMP.

3. PIPE MATERIAL :
a) PIPE ≤ 50 NB SHALL BE OF STAINLESS STEEL ASTM A312 TP 304 (SEAMLESS).
b) PIPE > 50 NB SHALL BE OF STAINLESS STEEL ASTM A312 TP 304 (ERW).
c) STAINLESS STEEL FITTINGS SHALL BE TO ASTM A-403 OF CORRESPONDING PIPE THICKNESS (AS A MIN.) WITH DIMENSIONS TO ANSI B 16.9.

4. UNLESS NOTED OTHERWISE ALL DRAINS & VENT SHALL BE OF Nb 25.
5. DRAINS & VENTS ALONGWITH DRAIN & VENT VALVES SHALL BE PROVIDED AT ALL LOW POINTS AND HIGH POINTS BASED ON LAYOUT AS REQUIRED.

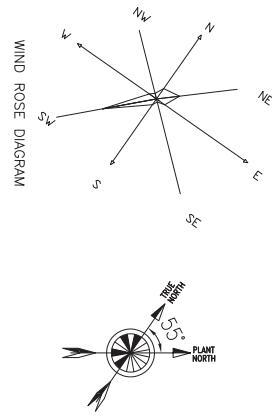
7. N6 SHALL BE LOCATED ABOVE N4.



1. PE-DG-410-100-N100 LEGEND

2. PE-DG-410-100-N109 P&ID CONDENSATE TRANSFER SYSTEM

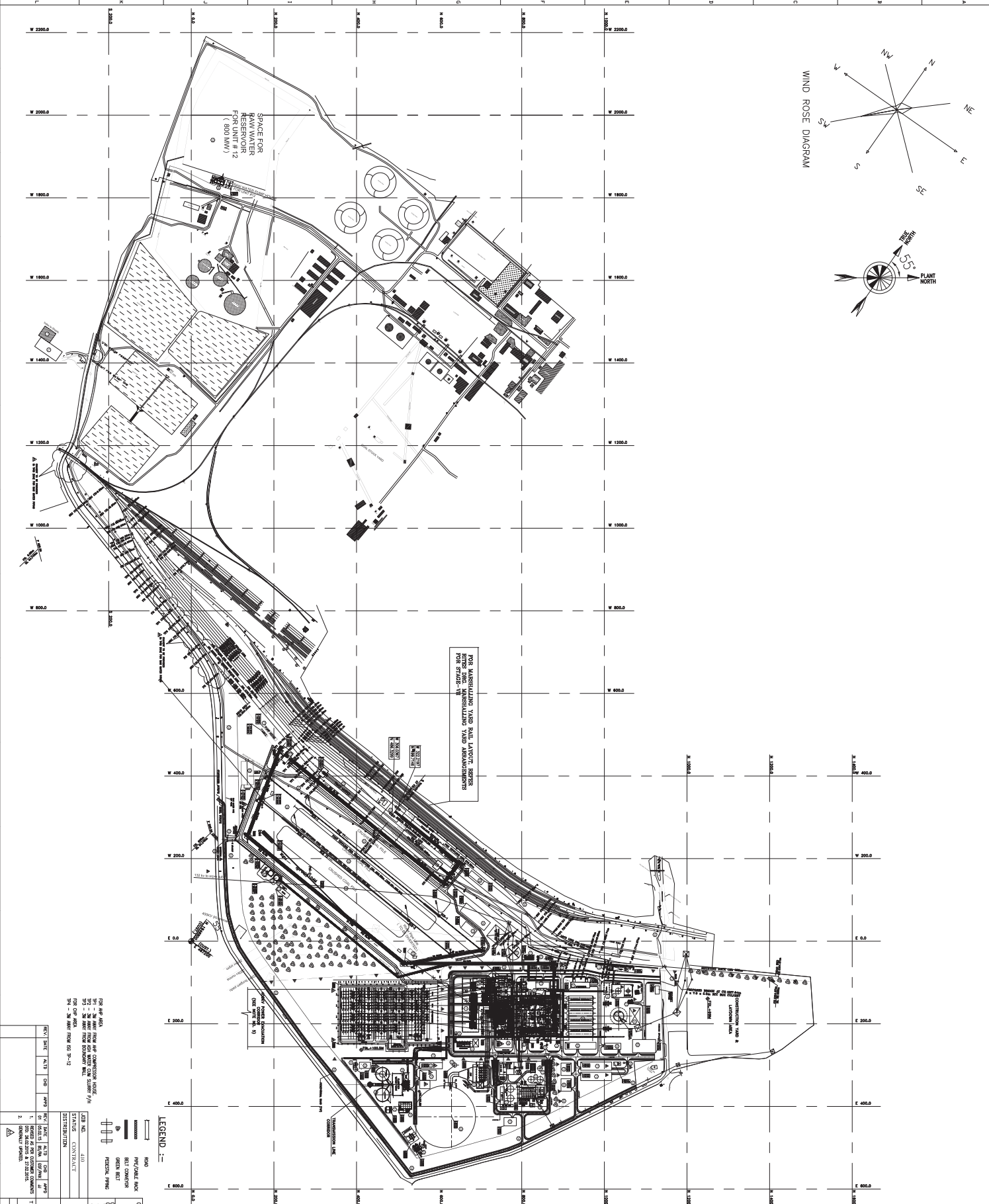
	TELANGANA STATE POWER GENERATION CORPORATION LIMITED	
	DEVELOPMENT CONSULTANTS PVT. LTD. KOLAKATA	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT. LTD.	
	KOTHAGUDAM THERMAL POWER STATION	
	STAGE-VII UNIT #12	
	PROJECT	
	BHARAT HEAVY ELECTRICALS LTD.	
	P&ID CONSULTANTS PVT	



PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

ALL INFORMATION IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.

COMPUTER FILE NAME: PE-3C-410-100-MOD_REV100



FOR INSTALLING YARD RAIL LAYOUT, SERIES RINGS AND INSTALLING YARD ARRANGEMENTS FOR STAGE-10

LEGEND :-

PROGRESSIVE COPY

- NOTES:-**
1. ALL BUILDINGS AND CO-ORDINATES ARE IN METRIC UNITS UNLESS OTHERWISE SPECIFIED.
 2. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 3. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 4. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 5. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 6. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 7. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 8. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 9. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 10. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 11. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 12. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 13. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 14. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 15. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 16. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 17. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 18. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 19. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 20. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 21. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 22. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 23. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 24. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 25. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 26. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 27. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 28. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 29. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 30. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 31. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 32. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 33. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 34. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 35. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 36. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 37. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 38. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 39. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 40. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 41. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 42. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 43. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 44. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 45. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 46. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 47. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 48. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 49. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 50. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 51. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 52. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 53. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 54. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 55. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 56. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 57. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 58. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 59. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 60. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 61. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 62. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 63. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 64. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 65. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 66. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 67. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 68. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 69. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 70. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 71. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 72. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 73. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 74. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 75. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 76. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 77. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 78. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 79. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 80. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 81. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 82. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 83. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 84. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 85. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 86. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 87. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 88. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 89. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 90. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 91. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 92. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 93. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 94. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 95. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 96. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 97. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 98. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 99. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.
 100. THE EXISTING BUILDINGS SHOWN IN THE PLAN ARE TO BE MAINTAINED AS IS.

REFERENCE DWG. :-

1. 100M-001-019-DG-343-00-SUBMITTAL

PROGRESSIVE COPY

CLIENT: TELANGANA STATE POWER GENERATION CORPORATION LTD
PROJECT: 1800 MW KOTHAGUDA TSS STAGE-VII UNIT#12, PUNUCHA DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEER: BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEER: BHARAT HEAVY ELECTRICALS LTD

NO.	REVISION	DATE	BY	CHKD	APPD	DESCRIPTION
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

NO.	REVISION	DATE	BY	CHKD	APPD	DESCRIPTION
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

DATE	SIGN	DATE
-54-		04.02.2015
-54-		04.02.2015
-54-		04.02.2015
-54-		04.02.2015
-54-		04.02.2015



TITLE:
**TECHNICAL SPECIFICATION FOR
DM PLANT**
**1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

SPECIFICATION NO.: PE-TS-410-163-A001	
VOLUME III	
REV. NO. 00	DATE:

VOLUME-III



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT

1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

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

Note: Bidder to furnish all the pre bid in the above indicated pre bid clarification format only. General pre bid clarification will not be considered.



TITLE:

TECHNICAL SPECIFICATION FOR DM PLANT

**1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE -VII, PALONCHA**

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00	DATE:

REV. NO. 00	DATE:

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL

PROJECT:- 1X800 MW TSGENCO KOTHAGUDEM TPS STAGE -VII, PALONCHA

PACKAGE:-DM PLANT

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOLUME/ 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

TECHNICAL DEVIATIONS

[illegible]

COMMERCIAL DEVIATIONS

[illegible]

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatch able items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.

**TITLE:****TECHNICAL SPECIFICATION FOR
DM PLANT****1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA**

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of 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.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

DRAWING/DOCUMENTS SUBMISSION SCHEDULE

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

For the Drawings/Documents Submission Procedure, please refer following Annexure-A. 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. The number of drawing/documents to be submitted by the bidder shall be as per Annexure-IV in Section C1 Volume IIB.

Every revised submission incorporating comments shall be resubmitted within 7 days.

BHEL shall provide observation / approval within 15 days from the date of document submission by bidder.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fort nightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

ANNEXURE – A

SL. NO.	BHEL DRAWING/ DOCUMENT NUMBER	DRAWING/ DOCUMENT TITLE	NO. OF WEEKS FOR DRAWING/ DOCUMENT SUBMISSION AFTER PLACING LOI/LOA	APPR OVAL CATE GORY	SIZE OF DRAWIN G/ DOCUME NT
1	PE-V0-410-163-A001	P&I DIAGRAM FOR DM PLANT	4	A	A1
2	PE-V0-410-163-A002	EQUIPMENT LAYOUT OF DM PLANT ALONG WITH MECHANICAL GA OF DM PLANT BUILDING	4	A	A1
3	PE-V0-410-163-A003	PROCESS DESIGN AND SIZING CALCULATIONS , RESIN DATA SHEET, VESSEL THICKNESS AND PRESSURE DROP CALCULATIONS FOR DM PLANT	4	A	A4
4	PE-V0-410-163-A004	SUB-VENDOR LIST FOR DM PLANT	4	A	A4
5	PE-V0-410-163-A005	OPERATION & CONTROL PHILOSOPHY OF DM PLANT ALONG WITH CONTROL SYSTEM PLC CONFIGURATION DIAGRAM	4	A	A4
6	PE-V0-410-163-A006	GA DRAWING OF ATMOSPHERIC TANKS OF DM PLANT	6	A	A2
7	PE-V0-410-163-A007	GA DRAWING OF PRESSURE VESSELS OF DM PLANT	6	A	A2



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

8	PE-V0-410-163-A008	TECHNICAL DATA SHEET FOR VALVES OF DM PLANT	8	A	A4
9	PE-V0-410-163-A009	TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS OF DM PLANT	8	A	A4
10	PE-V0-410-163-A010	TECHNICAL DATA SHEET FOR METERING PUMPS/EJECTORS OF DM PLANT (AS APPLICABLE)	8	A	A4
11	PE-V0-410-163-A011	TECHNICAL DATA SHEET OF BLOWERS OF DM PLANT	8	A	A4
12	PE-V0-410-163-A012	TECHNICAL DATA SHEET FOR MOTOR OF DM PLANT	8	A	A4
13	PE-V0-410-163-A013	TECHNICAL DATA SHEET OF INSTRUMENTS OF DM PLANT	8	A	A4
14	PE-V0-410-163-A014	TECHNICAL DATA SHEET OF ANALYZER OF DM PLANT	8	A	A4
15	PE-V0-410-163-A015	TECHNICAL DATASHEET OF RESIN TRAP, CARBON TRAP, MEDIA TRAP, ACTIVATED CARBON OF DM PLANT	8	A	A4
16	PE-V0-410-163-A016	TECHNICAL DATA SHEET FOR HEATER & RESIN OF DM PLANT	8	A	A4
17	PE-V0-410-163-A017	PIPING LAYOUT OF DM PLANT	10	A	A1
18	PE-V0-410-163-A018	YARD PIPING LAYOUT OF DM PLANT	12	I	A1
19	PE-V0-410-163-A019	QAP FOR VALVES OF DM PLANT	6	A	A4
20	PE-V0-410-163-A020	QAP FOR HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS WITH MOTOR OF DM PLANT	6	A	A4



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

21	PE-V0-410-163-A021	QAP FOR METERING PUMPS WITH MOTOR/EJECTOR OF DM PLANT	6	A	A4
22	PE-V0-410-163-A022	QAP FOR BLOWERS WITH MOTOR OF DM PLANT	6	A	A4
23	PE-V0-410-163-A023	QAP FOR ATMOSPHERIC TANKS OF DM PLANT	6	A	A4
24	PE-V0-410-163-A024	QAP FOR PRESSURE VESSELS OF DM PLANT	6	A	A4
25	PE-V0-410-163-A025	QAP / ICL OF DM PLANT (FOR BALANCE OF ITEMS)	6	A	A4
26	PE-V0-410-163-A026	CIVIL ASSIGNMENT DRAWING FOR DM PLANT	10	A	A1
27	PE-V0-410-163-A027	ELECTRICAL LOAD DATA FOR DM PLANT	12	A	A4
28	PE-V0-410-163-A028	INSTRUMENT SCHEDULE OF DM PLANT	12	I	A3
29	PE-V0-410-163-A029	VALVE SCHEDULE OF DM PLANT	12	I	A3
30	PE-V0-410-163-A030	INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS	12	A	A3
31	PE-V0-410-163-A031	FIELD JB TERMINATIONS /GROUPING DOCUMENT	12	A	A3
32	PE-V0-410-163-A032	PLC PANEL GA (INTERNAL & EXTERNAL) DRAWING	10	A	A1
33	PE-V0-410-163-A033	CONTROL SCHEMES (BLOCK LOGIC)	12	A	A3



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

34	PE-V0-410-163-A034	PLC INPUT / OUTPUT SIGNAL LIST	12	A	A3
35	PE-V0-410-163-A035	UPS BATTERY CHARGER/ BATTERY DATASHEET & SLD	10	A	A4
36	PE-V0-410-163-A036	UPS SIZING CALCULATIONS	10	A	A4
37	PE-V0-410-163-A037	BATTERY SIZING CALCULATIONS	10	A	A4
38	PE-V0-410-163-A038	CONTROL DESK LAYOUT / GA DRAWING	10	A	A1
39	PE-V0-410-163-A039	PLC -OWS/PRINTER FURNITURE BOM	10	A	A4
40	PE-V0-410-163-A040	PLC CATALOGUE	10	A	A4
41	PE-V0-410-163-A041	PLC QUALITY PLAN & FAT PROCEDURE	6	A	A4
42	PE-V0-410-163-A042	LIST OF SIGNAL EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL FORMAT)	12	A	A4
43	PE-V0-410-163-A043	PROCESS GRAPHIC MANUSCRIPTS PLC	12	A	A3
44	PE-V0-410-163-A044	PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS	12	A	A1
45	PE-V0-410-163-A045	CABLE SCHEDULE (IN BHEL EXCEL FORMAT) & CABLE INTERCONNECTION DETAILS	12	A	A3
46	PE-V0-410-163-A046	PANEL & ELECTRONIC EARTHING REQUIREMENT	12	A	A1



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

47	PE-V0-410-163-A047	PANEL HEAT DISSIPATION DATA	12	A	A4
48	PE-V0-410-163-A048	PLC EARTHING SCHEME	12	A	A1
49	PE-V0-410-163-A049	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM AND EARTHING LAYOUT OF DM PLANT	12	A	A1
50	PE-V0-410-163-A050	CABLE INTERCONNECTION DRAWING FOR DM PLANT	12	A	A3
51	PE-V0-410-163-A051	PG TEST PROCEDURE FOR DM PLANT	16	A	A4
52	PE-V0-410-163-A052	ENGINEERING BOQ OF DM PLANT	16	A	A4
53	PE-V0-410-163-A053	O&M MANUAL FOR DM PLANT	24	A	A4/A3/A2/ A1 AS APPLICABLE

Notes:

1. A= APPROVAL. I = INFORMATION.
2. Any additional drawings-documents required during detailed engineering stage shall be provided by bidder without any commercial, technical and delivery implication to BHEL and customer.
3. Non-submission of the document as per attached schedule will attract LD.
4. Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure IV of this specification. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end
 - Internet explorer version – Minimum Internet Explorer 7
 - Internet speed – 2 mbps (Minimum preferred)
 - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
 - Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)
 - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
 - For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X800 MW TSGENCO KOTHAGUDEM TPS STAGE –VII, PALONCHA	SPECIFICATION NO.: PE-TS-410-163-A001	
		VOLUME III	
		REV. NO. 00	DATE:

COMPLIANCE CUM CONFIRMATION SCHEDULE

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

- a.) 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.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
- c.) 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.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
- e.) 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.
- f.) 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).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval.
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUEDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

PROJECT: 1X800 MW TSGENCO KOTHAGUEDEM TPS STAGE –VII, PALONCHA

SUGGESTIVE PRICE SCHEDULE

DM PLANT

1.0	Total lump sum firm price on FOR site basis to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trial run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of DM PLANT as per the details in different sections / volumes of this specification for 1X800 MW TSGENCO KOTHAGUEDEM TPS,STAGE-VII, PALONCHA.		
a)	Bidder to note that total price indicated above at 1 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.		
b)	In case, price indicated above does not match with item wise break-up given at 2, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.		
2.0	MAJOR BREAK-UP OF PRICES GIVEN IN 1 ABOVE		
2.01	Total lumpsum firm price for EQUIPMENT (SUPPLY, DESIGN & ENGINEERING) i.e. Manufacture, fabrication, assembly, inspection and testing at vendor's & sub-vendor's works, painting, spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, inclusive of all taxes & duties for the complete scope of supply of DM PLANT defined as per tender technical specification (PE-TS-410-163-A001).		
2.02	Total lump sum firm price for all services including unloading, handling & transportation at site, Erection & Commissioning, trial run, preparation & submission of "As Built" drawings, etc, required for completion of DM PLANT as per tender technical specification (PE-TS-410-163-A001).		
2.03	Price for Performance Guarantee test and handing over the plant to the customer.		
2.04	Price for Mandatory spares (as per list indicated in Section C1 Annexure - VI of Specification).		
3.0	Recommended spares (optional item).		
4.00	Break-up (%) of prices given at SI No-2.1 above (To be used during contract execution for payment).		
4.01	Lumpsum firm price for supply of Pressure vessels inclusive of all taxes, duties and other levies as applicable.	18% of sl no 2.01 above.	
4.02	Lumpsum firm price for supply of Resin inclusive of all taxes, duties and other levies as applicable.	12% of sl no 2.01 above.	
4.03	Lumpsum firm price for supply of Atmospheric tank inclusive of all taxes, duties and other levies as applicable.	14% of sl no 2.01 above.	
4.04	Lumpsum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.01 above.	



TITLE:
TECHNICAL SPECIFICATION FOR
DM PLANT
1X800 MW TSGENCO KOTHAGUDEM TPS
STAGE –VII, PALONCHA

SPECIFICATION NO.: PE-TS-410-163-A001

VOLUME III

REV. NO. 00

DATE:

4.05	Lumpsum firm price for supply of Instruments & Analyser inclusive of all taxes, duties and other levies as applicable.	10% of sl no 2.01 above.	
4.06	Lumpsum firm price for supply of Rotary Equipments (Pumps, Blowers, Agitators etc.) inclusive of all taxes, duties and other levies as applicable.	11% of sl no 2.01 above.	
4.07	Lumpsum firm price for supply of Piping & Fittings inclusive of all taxes, duties and other levies as applicable.	10% of sl no 2.01 above.	
4.08	Lumpsum firm price for supply of Balance items inclusive of all taxes, duties and other levies as applicable.	10% of sl no 2.01 above.	

Bidder shall furnish this price schedule in his offer only

Particulars of bidder / authorised representative

Name	Designation	Signature	Date	Company seal

