

**TAMILNADU GENERATION & DISTRIBUTION
CORPORATION LIMITED**

1X800MW NORTH CHENNAI TPP STAGE –III-BTG

**TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO: PE-TS-423-154A-A001



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

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION -
		SUB SECTION -
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

SECTION	DESCRIPTION	PAGE NO.
	PROJECT INFORMATION	1-8
SECTION – I	SPECIFIC TECHNICAL REQUIREMENTS	9
SUB-SECTION – IA	SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)	10-138
	ANNEXURE I : QUALITY PLAN	
	ANNEXURE II :SUB VENDORS LIST	
	ANNEXURE III :DRAWING DOCUMENTS DISTRIBUTION PROCEDURE	
	ANNEXURE IV :PAINTING SPECIFICATION	
	ANNEXURE V :MANDATORY SPARES LIST	
	ANNEXURE VI: LIST OF ERECTION & COMMISSIONING SPARES	
	ANNEXURE VII :DRAWING/DOCUMENTS SUBMISSION SCHEDULE	
	ANNEXURE VIII :FORMAT FOR OPERATION AND MAINTENANCE MANUAL	
	ANNEXURE IX-GENERAL TECHNICAL REQUIRMENTS	
	P&ID	
	DATA SHEET-A	
	MAIN EQUIPMENT PLAN LAYOUT	
SUB-SECTION – IB	SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)	139-166
	ELECTRICAL EQUIPMENT SPECIFICATION (MOTOR)	
	ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR	
	ELECTRICAL LOAD DATA FORMAT	
	CABLE SCHEDULE FORMAT	
SUB-SECTION – IC	SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)	167-168
SECTION – II	GENERAL TECHNICAL REQUIREMENT	169
SUB-SECTION – IIA	GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	170-201
SUB-SECTION – IIB	GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)	202-286
SUB-SECTION – IIC	GENERAL TECHNICAL REQUIREMENT (CONTROL AND INSTRUMENTATION)	287-358
SECTION - III		359
	SCHEDULE OF PRE BID CLARIFICATIONS	360
	COMPLIANCE CUM CONFIRMATION SCHEDULE	361
	SCHEDULE OF DECLARATION	362
	SCHEDULE OF DEVIATION WITH COST OF WITHDRAWAL	363

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION
		SUB-SECTION -
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

PROJECT INFORMATION



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III

EPC TENDER SPECIFICATION FOR BTG PACKAGE



PROJECT INFORMATION

1.1 GENERAL

TANGEDCO has planned to establish 1X800MW Coal Based Super Critical North Chennai Thermal Power Project Stage III in the premises of existing NCTPS at Ennore & Puzhuthivakkam Village, Ponneri Taluk, Thiruvallur District, Tamil Nadu, India. This project will be executed in two package mode i.e, BTG with related Civil Works and BOP with related Civil Works.

1.2 LOCATION

The proposed site for main power plant is located near Ennore port (approx 5 km) and also 35 km from Chennai City.

The nearest Railway station is at Athipattu Pudunagar (approx 5 km)

All weather road from Pattamandri on the Thiruvotriyur-Ponneri highway is the nearest road access.

The nearest airport is at Chennai at a distance of 60 km.

1.3 PROJECT INFORMATION

1.1	Project Title	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
1.2	Plant capacity	:	800 MW
1.3	Type of project	:	Brown field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	In the premises of North Chennai Thermal Power Station (NCTPS)
1.6	Location co-ordinates	:	80° 19' E to 80° 20' E Longitude 13° 13' N to 13° 18' N Latitude
1.7	Nearest Village	:	Ennore & Puzhuthivakkam Village
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.10	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai – Vijayawada Line
1.11	Nearest Airport	:	Chennai (~ 60 Km)
1.12	Nearest Seaport	:	Ennore (~ 3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway
2.0	Meteorological Condition		
2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	45 °C
b.	Annual Minimum Mean Temperature	:	15 °C
c.	Design ambient temperature	:	30 °C
2.4	Relative Humidity		
a.	Maximum	:	90 %
b.	Minimum	:	36 %
c.	Design	:	75 %
2.5	Annual Rainfall		
	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002
2.8	Design ambient temperature for Electrical equipment	:	50 °C

1.4 ACCESS TO SITE

Site is well connected to all weather road from Pattamandri on the Thiruvotriyur – Ponneri highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

1.5 PLANT RATING, CAPACITY, AVAILABILITY, PLF

Plant continuous rating will be 800MW at Generator terminals based on the following site conditions.

- Ambient Air temperature
- Condenser cooling water inlet temperature of 33 Deg. C and 9 Deg. C temperature rise across the condenser.
- Generator Power factor of 0.85
- Fuel Specification as given elsewhere
- Design temperature of electrical equipment is 50 Deg. C

The VWO capacity of the steam turbine shall not be less than 105% TMCR flow at rated parameters. Boiler maximum Continuous Rating (MCR) is at least 1.02 times the steam flow at turbine VWO condition plus continuous auxiliary steam requirement of unit at TMCR, rounded to next integer divisible by 5.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc. The plant load factor (PLF) being considered is 85%.

1.6 SOURCES OF FUEL

TANGEDCO has long term linkage of Coal from the coal sources of Talcher or Mahanadi in Orissa. Domestic coal requirement for the power plant will be sourced from kalinga block of the Talcher, Mahanadhi and IB valley coal field.

The Imported coal has been sourced from foreign countries through sea to Ennore port. The coal will be conveyed from port through conveying system.

The steam generator shall be designed for the following conditions:

- Best Coal – 100% Imported Coal
- Design Coal – 70% Imported & 30% Domestic Coal
- Worst Coal – 50% Imported & 50% Domestic Coal



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.7 Coal Analysis

1.7.1 Coal Quality parameter

a) Domestic Coal

A. Proximate Analysis			
1.	Total Moisture	%	16.0
2.	Ash	%	45.0
3.	Volatile matter	%	19.0
4.	Fixed Carbon	%	20.0
5.	Gross calorific value (as received basis)	kcal/kg	2800
B. Ultimate Analysis			
1.	Carbon	%	27.7
2.	Hydrogen	%	2.6
3.	Sulphur	%	0.5
4.	Nitrogen	%	0.52
5.	Oxygen	%	7.26
6.	Moisture	%	16.0
7.	Ash	%	45.0
8.	HGI		45 -55, Avg 52
9.	Carbonates		0.38
10.	Phosphorous		0.04
11.	YGP Index	mg/kg	50-70
12.	Shale and Sand stone Content	%	Max 20
13.	Feed Coal Size	mm	Upto 50
C Ash Fusion Temperature			
	Initial Deformation, IT	Deg. C	1100
	Spherical, ST	Deg. C	1200
	Hemispherical, HT	Deg. C	1300
	Fluid, FT	Deg. C	-
ASH ANALYSIS			
	SiO ₂	%	59.54
	Al ₂ O ₃	%	29.00
	Fe ₂ O ₃	%	6.42
	CaO	%	1.50
	Na ₂ O	%	0.08
	K ₂ O	%	-
	TiO ₂	%	1.60
	SO ₃	%	0.25
	P ₂ O ₅	%	0.51
	MgO	%	0.50
	Others	%	0.60
	Total		100.00
	Resistivity of Fly Ash	Ohm-cm	1.73 X10 ¹²



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

b) Imported Coal

A. Proximate Analysis			
1.	Total Moisture	%	16.50
2.	Ash	%	6.62
3.	Volatile matter	%	36.45
4.	Fixed Carbon	%	40.43
5.	Gross calorific value (as received basis)	kcal/kg	5642
B. Ultimate Analysis			
1.	Carbon	%	60.12
2.	Hydrogen	%	4.38
3.	Sulphur	%	0.53
4.	Nitrogen	%	1.48
5.	Oxygen	%	10.37
6.	Moisture	%	16.5
7.	Ash	%	6.62
8.	HGI		51
9.	Carbonates		-
10.	Phosphorous		-
11.	Total		100
C Ash fusion temperature			
	Initial Deformation, IT	Deg. C	1230
	Spherical, ST	Deg. C	1270
	Hemispherical, HT	Deg. C	1320
	Fluid, FT	Deg. C	-
ASH ANALYSIS			
	SiO ₂	%	36.00
	Al ₂ O ₃	%	13.90
	Fe ₂ O ₃	%	14.80
	CaO	%	12.70
	Na ₂ O	%	0.70
	K ₂ O	%	1.70
	TiO ₂	%	0.80
	SO ₃	%	10.6
	P ₂ O ₅	%	0.20
	MgO	%	8.60
	Others	%	-
	Total		100.00



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c) The plant should be suitable to accept imported coal sourced from any country. The limiting parameters of imported coal are furnished below :

A. Proximate Analysis			
1.	Total Moisture (ARB)	%	Upto 23 Max
2.	Ash (ADB)	%	6.62
3.	Gross calorific value (as dried basis)	kcal/kg	5800 - 6500
4.	Fixed Carbon(ADB)	%	30 - 50
5.	Volatile Matter (ADB)	%	25 - 45
6	HGI		45 - 60
7	IDT (Under Reducing Atmosphere)	Deg.C	1100 - 1250
3.	Sulphur (ADB)	%	Upto 1 Max
4.	Size	mm	< 50

1.7.2 Specification of LDO

Specific Gravity @ 15° C kg/cu.m	: 0.8348
Gross calorific value, kcal/kg	: 10400
Pour point "°C" max.	: 12
Flash point "°C" min.	: 66
Sulphur % "T" max.	: 0.5
K. Viscosity in Centistokes @ 50° C Max	: 7.5
Ash by wt. %	: 0.01
Water & Sediment content Vol. Max. %	: 0.25
Sediment Max. Content by Wt%	: 0.1
Relevant Indian Standard	: IS 1460

1.7.3 Specification of HFO

Flash point "°C" min.	: 66
Sulphur % "T" max.	: 4.5
Viscosity in Centistokes @ 50° C	: 370
Ash by wt. %	: 0.1
Water content Vol. Max. %	: 1.0
Sediment Max. Content by Wt%	: 0.25
Gross Calorific Value, kcal/kg	: 10800

1.8 Fuel Transportation

The coal shall be received at Ennore port. The coal will be transported by conveyor from coal berth 3 in Ennore Port and then through the conveyor to the coal bunker directly or to coal stockyard.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.9 SOURCE OF WATER

Source of water for the proposed project is sea water. The intake shall be from the existing cooling water fore bay of NCTPS Stage-II. Treated water shall be provided to the plant cycle makeup and other requirements of BTG package at the respective terminal points. Refer Chapter 4 of this section.

1.10 SOURCE OF EQUIPMENT

The proposed plant will be supplied, erected and commissioned on dual EPC basis, i.e, BTG with related civil works and BOP with related civil works.

1.11 POWER EVACUATION PLAN

1x800MW Steam Generating Units shall be with a SF6 Generator Circuit Breaker [GCB] along with necessary additional items between Generator Transformer [GT] and Generator. Therefore GT shall be used for unit start-up / unit shutdown as well as for power evacuation by synchronization of unit by closing GCB.

Power will be evacuated from the proposed thermal power station at 765 KV voltage level through 765 KV transmission lines. The power evacuation lines would be double circuit 765 KV lines which will act as Line in & Line out circuit.

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE –III-BTG	SUB SECTION -
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

SECTION I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA: SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

SUB-SECTION IB: SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

SUB-SECTION IC: SPECIFIC TECHNICAL REQUIREMENTS (C&I)

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE –III-BTG	SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

SUB-SECTION IA

SPECIFIC TECHNICAL REQUIREMENTS - MECHANICAL

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

1. SCOPE:

Design, engineering, manufacture, supply, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance/special tools & tackles (as applicable), mandatory spares, start up and commissioning spares, special tools and tackles (as applicable), forwarding, proper packing, shipment and delivery at site, preparation and submission of drawing /documents including "As Built" drawings and O&M manuals & equipment / system guarantee etc. as specified hereinafter for the **1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG** for following systems:-

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

The following drawings/ data sheets are enclosed:

- P&ID for Hydrazine Dosing System (PE-DG-423-154-A001). Rev 0
- P&ID for Ammonia Dosing System (PE-DG-423-154-A002). Rev 0
- P&ID for NaOH Dosing System (PE-DG-423-154-A003). Rev 0
- DATA SHEET - A - For above systems.

2. DESIGN PHILOSOPHY:

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

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

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

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

4. LOW PRESSURE CHEMICAL DOSING:

4.1 HYDRAZINE DOSING SYSTEM: (TOTAL NO. OF SKID = 2NOS.)*** (Refer drawing no. PE-DG-423-154-A001, Rev 00)

Residual oxygen present in feed water can be detrimental to feed cycle equipments. In order to control the same, continuous dosing of dilute solution of hydrazine is done at deaerator outlet (BFP suction) only. Though provision has been kept to dose hydrazine at CEP discharge and boiler fill pump discharge header also, but dosing shall be done at one place at a time. For this purpose one (1) no. skid mounted Hydrazine dosing system shall be provided. Hydrazine concentration used during the wet laying condition shall be 35% and during normal operation shall be 0.6%. Location of hydrazine dosing systems inside TG hall 0.0 M. Hydrazine dosing system shall mainly comprise of the following:

4.1.1 HYDRAZINE SOLUTION PREPARATION & STORAGE TANK (1 No. Per Skid)

One (1) number Hydrazine mixing / storage tank for preparing & storing the dilute Hydrazine solution shall be provided. A dilute solution shall be prepared in the solution mixing cum storage tank using condensate and shall be uniformly mixed by a motorized stirrer (100 - 200 rpm). The tank shall be provided with accessories like motorized stirrer, level indicator, level transmitter, over flow and a breather with vent (arrest the hydrazine vapours coming out of the tank and to exclude absorption of atmospheric air by the solution).

4.1.2 HYDRAZINE MEASURING TANK (1 No. Per Skid)

One (1) number Hydrazine measuring tank for measuring the concentrated Hydrazine shall be provided. The tank shall be provided with accessories like breather with vent, level indicator, and level transmitter, overflow & drain connections. A filling connection (A funnel and cock arrangement) shall be provided to fill the

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

concentrated hydrazine solution from hand pump in the measuring tank. Concentrated solution shall be transferred to Hydrazine mixing / storage tank by gravity flow when solution is to be prepared.

4.1.3 HYDRAZINE DOSING PUMPS (2 Nos. Per Skid)

Two numbers (2 X 100%) Positive displacement plunger type metering pumps (electrically operated, auto adjusted) with relief valves shall be provided.

The stroke of the pumps shall be adjustable from zero to 100% even when the pump is in operation so as to achieve a step-less variation of capacity over the specified range of operation.

Two nos. Y type strainers (2 x 100%) (Common for both pumps, 1W+1SB) shall be provided in the suction line of the pump with Differential Pressure Transmitter (DPT) and Differential Pressure Indicator (DPI). The pump shall also be provided with a pressure indicator in the individual discharge line.

4.1.4 BARREL PUMP (1 NO.)

An electrically operated barrel pump (1X100%) complete with flexible hose and couplings for transferring hydrazine from drum/ carboys placed at finished floor level near to Hydrazine dosing skid to Hydrazine measuring Tank shall be provided.

4.1.5 ASSOCIATED PIPING, VALVES ETC:

As indicated in the drawing enclosed, to make the system complete, all associated piping & valves shall be provided. All piping in the skid shall be ASTM A312 Gr. TP 304 (seamless) SCH. 40, pipe size: 40/25 Nb. Valve & fitting materials shall be ASTM A 182 GR.F304, ASA 800 rating, end connections shall be as per ANSI B - 16.11/SW . All valves shall be manually operated.

Since quantity of liquid is very small and occurrence of such cases is very rare, Drains from tanks & pipes & level indicator shall be inter-connected to a common drain header through pipe and shall be terminated at one side of a skid at skid battery limit. Further same shall be terminated to nearest TG hall inside drain.

4.1.6 PARAMETERS FOR HYDRAZINE DOSING:

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

4.1.7 FLUSHING

Condensate tapped from main condensate water line shall be used for preparation of solution and for flushing the various pipes lines and pumps of the system as shown in P & I drawing.

***Remarks: Redundancy of 100% of hydrazine dosing skid has been asked for hence total 2 nos. hydrazine dosing skid shall be supplied for project. Further for hydrazine stand by skid please refer the P&ID of hydrazine dosing system standby skid.

4.2 AMMONIA DOSING SYSTEM; (TOTAL NO. OF SKID = 2NOS.)*** (Refer drawing number PE-DG-423-154-A002. Rev. 00)

Boiler feed water/Condensate water should have proper pH in order to protect the system from corrosion. In order to control the same dosing of dilute solution of Ammonia is done at Condensate Extraction Pump Discharge Header (at CPU outlet). Though provision has been kept to dose ammonia at deaerator outlet and boiler fill pumps discharge header also, but dosing shall be done at one place at a time only. For this purpose one (1) no. skid mounted ammonia-dosing system per unit shall be provided. Ammonia concentration used during the wet laying condition shall be 15% and during normal operation shall be 30%. Location of Ammonia dosing systems inside TG hall 0.0 M. Ammonia Dosing system shall mainly comprise of the following:

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

4.2.1 AMMONIA MIXING / STORAGE TANK (1 No. Per Skid)

An Ammonia mixing/storage tank for mixing & storing the Ammonia shall be provided. A dilute solution shall be prepared in the ammonia mixing/storage tank using condensate and shall be uniformly mixed by a motorized stirrer (100-200 rpm). The tank shall be provided with accessories like breather with vent, motorized stirrer, level indicator, level transmitter and over flow sealing connection.

4.2.2 AMMONIA MEASURING TANK (1 No. Per Skid)

One (1) number Ammonia measuring tank for measuring the concentrated ammonia shall be provided. The tank shall be provided with accessories like breather with vent, level indicator, level transmitter, overflow sealing & drain connections. A filling connection (A funnel and cock arrangement) shall be provided to fill the concentrated ammonia solution from hand pump in the measuring tank. Concentrated solution shall be transferred to Ammonia mixing / storage tank by gravity flow when solution is to be prepared.

4.2.3 AMMONIA DOSING PUMPS (2 Nos. Per Skid)

Two numbers (2 X 100%) Positive displacement plunger type metering pumps (electrically operated, auto adjusted) with relief valves shall be provided.

The stroke of the pumps shall be adjustable from zero to 100% even when the pump is in operation so as to achieve a step-less variation of capacity over the specified range of operation.

Two nos. Y type strainers (2 x 100%) (Common for both pumps, 1W+1SB) shall be provided in the suction line of the pump with Differential Pressure Transmitter (DPT) and Differential Pressure Indicator (DPI). The pump shall also be provided with a pressure indicator in the individual discharge line.

4.2.4 BARREL PUMP (1 NO.)

An electrically operated barrel pump (1X100%) complete with flexible hose and couplings for transferring Ammonia from drum/ carboys placed at finished floor level near to Ammonia dosing Skid to Ammonia measuring Tank shall be provided.

4.2.5 ASSOCIATED PIPING, VALVES ETC:

As indicated in the drawing enclosed, to make the system complete, all associated piping & valves shall be provided. All piping in the skid shall be ASTM A312 Gr. TP 304 (seamless) SCH. 40, pipe size: 40/25 Nb. Valve & fitting materials shall be ASTM A 182 GR.F304, ASA 800 rating, end connections shall be as per ANSI B - 16.11/SW. All valves shall be manually operated.

Since quantity of liquid is very small and occurrence of such cases is very rare, Drains from tanks & pipes & level indicator shall be inter-connected to a common drain header through pipe and shall be terminated at one side of a skid at skid battery limit. Further same shall be terminated to nearest TG hall inside drain.

4.2.6 PARAMETERS FOR AMMONIA DOSING:

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

4.2.7 FLUSHING

Condensate tapped from main condensate water line shall be used for preparation of solution and for flushing the various pipes lines and pumps of the system as shown in P & I drawing.

***Remarks: Redundancy of 100% of ammonia dosing skid has been asked for hence total 2 nos. AMMONIA DOSING SKID shall be supplied for project. Further for ammonia stand by skid please refer the P&ID of Ammonia dosing system standby skid.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

4.3 CONTROL PHILOSOPHY (COMMON FOR BOTH THE SYSTEMS):-

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

- i) Hydrazine dosing system
- ii) Ammonia dosing system

The operation of LP dosing system shall be as follows:-

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

The starter of all the motors shall be clubbed with Main plant MCC. Power to all pumps, agitators etc. shall be fed from MCC. Main Plant DCS commands shall extend to MCC.

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

The ON/OFF operation of all motorized stirrers and pumps shall also be provided in main Plant DCS with local ON, OFF facility and emergency OFF facility along with ON/OFF check backs.

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

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

1. Following interlocks shall be provided at low-low Level in the mixing /storage tank:
 - i) Running Dosing pump shall be tripped.
 - ii) Stirrer motor of the respective Mixing /storage tank shall be tripped.
2. Following conditions to be ensured before starting a stirrer:
 - i) Level in the Mixing / storage tank shall be adequate.
 - ii) Motor not overload.
3. Following conditions to be ensured before starting a pump:
 - i) Level in the Mixing / storage tank shall be adequate.
 - ii) Motor not overload.
 - iii) Y type Strainer- Not choked.
4. Following shall be provided on LCP:
 - i) ON/ OFF/ Fault- Lamp Indications for all drives (pumps & agitator)
 - ii) Operation 'Local selected' / operation 'Remote selected'- Lamp Indication, common for all drives.
 - iii) Pump- Start/ Stop/Emergency stop & Agitator-Start/Stop/Emergency stop –Push Buttons
 - iv) Auto stroke controller
 - v) Stroke position indicator (may be a part of controller)
 - vi) Local LED based annunciation driven by main Plant DCS.
5. Following fault indications with alarm annunciations shall be provided on LCP & in Plant DCS:
 - i) Low level in the mixing / storage tank.
 - ii) Low-low level in the mixing / storage tank
 - iii) High level in the mixing /storage tank
 - iv) High pressure at pump discharge header
 - v) Low pressure at pump discharge header
 - vi) Y –type Strainer choked.
 - vii) Running Dosing pump-1--tripped
 - viii) Running Dosing pump-2--tripped
 - ix) Stirrer/Agitator motor—tripped

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

- x) Low Level in the measuring tank
- xi) High level in the measuring tank
- xii) Running dosing motor & stirrer motor tripped due to low-low level in mixing / storage tank.

SIGNAL EXCHANGE

6. Following signals shall be wired from main **Plant DCS to LCP**. These shall be 24V DC powered signals. (PF contacts are not used to avoid the higher voltage LCP power supply reaching DDCMIS while contact interrogation).
 - i) Operation local selected
 - ii) Operation remote selected
 - iii) Pump- 1/2 & stirrer (ON/OFF/FAULT)
 - iv) Process conditions (as per clause 5 above)
 - v) Pump- 1/2 stroke length demand signal (4-20 mA)
7. Following signals shall be wired from LCP to main Plant DCS. Binary signals shall be P.F. contacts.
 - i) All field signals
 - ii) START/ STOP–PB commands for all drives (pumps & agitator)
 - iii) Dosing Pump- 1/2 stroke length feedback signal (4-20 mA).
8. Signal Exchange between main Plant DCS & MCC shall be as per applicable Drive Control Philosophy i.e.
 - i) START/ STOP command from Plant DCS to MCC.
 - ii) ON/OFF/MCC Disturbed feedback from MCC to Main plant DCS.
9. Signal Exchange between LCP & MCC shall be:
 - i) EMERGENCY STOP-PB for all drives (pumps & agitator).
10. Based on the Dissolved oxygen level & pH level in the condensate stroke of hydrazine & ammonia dosing pumps respectively shall be adjusted through DCS.
11. All the field instruments i.e. level transmitter, differential pressure transmitter, pressure transmitter etc. & stroke actuator shall be terminated at local panel by the vendor, for taking further to main Plant DCS.

Instrument cabling from instruments to LCP and pre-wiring within LCP shall be done by our chemical dosing vendor. Cabling between LCP & main Plant DCS shall be in BHEL scope.

4.4 NaOH DOSING SYSTEM FOR ECW SYSTEM: (TOTAL NO. OF SKID = 1 NO.) (Refer drawing number PE-DG-423-154-A003 Rev. 00)

Sodium Hydroxide (NaOH) dosing system shall be provided to dose NaOH solution in Equipment cooling water lines manually as per requirement of desired pH (pH around 9.5) in DMCW tank judged on trial basis. The Sodium Hydroxide Dosing shall be done in the ECW cycle during the initial fill and for the compensation of cooling water for any leakage during normal run. The solution of NaOH shall be prepared manually by opening the inlet valve of DM water and adding NaOH lye in basket. The NaOH shall be dissolved by starting the motorized stirrer locally. The solution shall then be dosed to the required point with the help of NaOH dosing pumps. NaOH concentration used during normal operation shall be 5%. Location of NaOH dosing systems inside TG hall 0.0 M. The dosing system shall consist of following:-

4.4.1 ALKALI PREPERATION/ DOSING TANK:

One (1) no NaOH Dosing Tank complete with motorized stirrer (100-200 rpm), CO2 absorber, dissolving basket, level indicator, level transmitter, vent, overflow with water seal & drain shall be provided.

4.4.2 NaOH DOSING PUMPS (2 NOS. PER SKID)

Two numbers (2 X 100%) Positive displacement plunger type metering pumps (electrically operated, auto adjusted) with relief valves shall be provided.

The stroke of the pumps shall be adjustable from zero to 100% even when the pump is in operation so as to achieve a step-less variation of capacity over the specified range of operation.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION I
		SUB SECTION - IA
		REV.NO. 0 DATE :

Two nos. Y type strainers (2 x 100%) (Common for both pumps, 1W+1SB) shall be provided in the suction line of the pump with Differential Pressure Transmitter (DPT) and Differential Pressure Indicator (DPI). The pump shall also be provided with a pressure indicator in the individual discharge line.

4.4.3 ASSOCIATED PIPING, VALVES ETC:

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

Since quantity of liquid is very small and occurrence of such cases is very rare, Drains from tanks & pipes & level indicator shall be inter-connected to a common drain header through pipe and shall be terminated at one side of a skid at skid battery limit. Further same shall be terminated to nearest TG hall inside drain.

4.4.4 PARAMETERS FOR NaOH DOSING:

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

4.4.5 CONTROL & INSTRUMENTATION

The operation of Dosing System shall be as follows: -

The control of the NaOH dosing system shall be realized in main Plant DCS including ON/OFF command of the individual pumps and stirrers. All controls, fault indications/alarms, interlocks, logics shall be implemented in main Plant DCS. Separate local panel shall be provided.

The starter of all the motors shall be clubbed with Main plant MCC. Power to all pumps, agitators etc. shall be fed from MCC. Main Plant DCS commands shall extend to MCC.

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

The ON/OFF operation of all motorized stirrers and pumps shall also be provided in main Plant DCS with local ON, OFF facility and emergency OFF facility along with ON/OFF check backs.

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

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

1. Following interlocks shall be provided at low-low Level in the alkali preparation cum dosing tank:

- Stirrer motor of the alkali preparation cum dosing tank shall be tripped.
- Running Dosing pump shall be tripped.

2. Following conditions to be ensured before starting a stirrer

- Level in the tank adequate.
- Motor not overload (MCC not disturbed).

3. Following conditions to be ensured before starting a pump

- Level in the alkali preparation cum dosing tank shall be adequate.
- Motor not overload (MCC not disturbed).
- 'Y' type strainer- Not choked

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

4. Following shall be provided on LCP

- i) ON/OFF/FAULT-Lamp indications for all drives (Pump & agitator).
- ii) Operation 'Local selected'/operation 'remote selected'-Lamp indications, common for all drives.
- iii) Local LED based annunciation driven by main Plant DCS
- iv) Pump- Start/Stop/Emergency Stop & Agitator-Start/Stop/Emergency Stop –Push Buttons
- v) Auto stroke controller
- vi) Stroke position indicator (may be a part of controller)

5. Following fault indications with alarm annunciation shall be provided in plant DCS & LCP:

- i) Low level in the alkali preparation cum dosing tank
- ii) Low-low level in the alkali preparation cum dosing tank
- iii) High level in the alkali preparation cum dosing tank
- iv) Stirrer motor tripped due to low-low level in the alkali preparation cum dosing tank.
- v) Running Dosing pump motor & stirrer motor tripped due to low-low level in the alkali preparation cum dosing tank.
- vi) 'Y' type strainer choked.
- vii) Low pressure at pump discharge header.
- viii) High pressure at pump discharge header.
- ix) Running dosing pump 1 trip.
- x) Running dosing pump 2 trip.

SIGNAL EXCHANGE

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

- i) Operation local selected.
- ii) Operation remote selected.
- iii) Pump- 1/2 & stirrer (ON/OFF/TRIP).
- iv) Process conditions (as per 5.1.4 Sr. No. 5)
- v) Pump- 1/2 stroke length demand signal (4-20 mA)

7. Following signals shall be wired from LCP to Plant DCS. Binary signals shall be P.F. contacts:

- i) All field signals.
- ii) START/ STOP- PB commands for all drives (pumps & agitator).
- iii) Pump- 1/2 stroke length feedback signal (4-20 mA).

8. Signal Exchange between main Plant DCS & MCC shall be as per applicable Drive Control Philosophy i.e.

- i) START/ STOP command from Plant DCS to MCC.
- ii) ON/OFF/MCC Disturbed feedback from MCC to Main plant DCS.

9. Signal Exchange between LCP & MCC shall be

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

10. Based on pH level in DMCW system stroke of NaOH dosing pumps shall be adjusted through DCS.

All the field instruments i.e. level transmitter, differential pressure transmitter, pressure transmitter etc. & stroke actuator shall be terminated at local panel by the vendor, for taking further to main Plant DCS.

Instrument cabling from instruments to LCP and pre-wiring within LCP shall be done by our chemical dosing vendor. Cabling between LCP & Plant DCS shall be in BHEL scope.

4.4.6 FLUSHING

DM Water shall be used for flushing the tank shown in attached drawing.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION I
		SUB SECTION - IA
		REV.NO. 0 DATE :

5.0 SCOPE OF SERVICE

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

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

6.0 CIVIL SCOPE

Nil.

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

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

8.0 QUALITY PLAN AND SUB VENDOR APPROVAL

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

9.0 DRAWINGS/DOCUMENTATION REQUIREMENT ALONG WITH BID

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

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

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

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

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION I
		SUB SECTION - IA
		REV.NO. 0 DATE :

10.0 DRAWING/DOCUMENTS REQUIREMENT (Pl refer electrical & C&I portion also):-

For the drawings/ documents submission schedule, please refer **Annexure-VII**.

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

11.0 SPARES

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

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

11.1 MANDATORY SPARES

- The list of mandatory spares is indicated in Annexure V.
- The bidder shall indicate the prices in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the BHEL & Customer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
- The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.
- All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- The Bidder shall note that if there is any change/ variation in equipment / system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

11.2 START-UP AND COMMISSIONING SPARES

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

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

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

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
		SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

11.3 MAINTENANCE TOOLS AND TACKLES

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

12.0 THE VENDOR WARRANTIES:

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

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION I
		SUB SECTION - IA
		REV.NO. 0 DATE :

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.

13.0 PACKING:

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

The actuator of the pump shall be packed in air tight packing along with the pump in installed condition for preventing damage of actuator.

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

14.0 DESIGN REQUIREMENTS

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

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

15.0 MISCELLANEOUS REQUIREMENTS

- a. Initial charge of all lubricants & grease.
- b. All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box.
- c. Finish paints for touch-up painting of equipment after erection at site in sealed container.
- d. All the first fill and one Year's topping requirements or 10 % of first fill quantity, whichever is more of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.
- e. Document approval by Customer/ BHEL under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval.
- f. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to Customer and BHEL for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA
		REV.NO. 0 DATE :

- g. In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at Customer/BHEL end, delay in review/ approval of drawing beyond one month will be to Customer/BHEL account.
- h. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the BHEL's switch gear /MCC on account of changed loads.
- i. 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.
- j. Relevant requirements as per GTR, GCC, ECC & SCC. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- k. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- l. Vendor to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval. Meeting can be held at site also.
- m. Latest version of all codes and standards to be followed.
- n. For detailed dispatch instructions, Bidder to refer special condition of contract (SCC) of the project.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001 SECTION -I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - IA REV.NO. 0 DATE :

ANNEXURES

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

	TITLE:		SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP		SECTION -I
	STAGE –III-BTG		SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR		REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM		

ANNEXURE I:

QUALITY PLAN

ANNEXURE-I														
MANUFACTURER'S NAME & ADDRESS :			QUALITY PLAN				PROJECT		1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG					
ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM :			QP.NO : PE-VO-423-154A-006				PACKAGE CONTRACT NO.		CHEMICAL DOSING SYSTEM 423					
			REV. : 0											
CHEMICAL DOSING SYSTEM			DATE :				1 OF 4		MAIN SUPPLIER		BHEL/PEM, NOIDA			
			PAGE :											
CATEGORY			EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORDS		AGENCY**		REMARKS	
CHARACTERISTICS CHECKED			TYPE/ METHOD CHECK		7		8		9		10		11	
S.NO.	COMPONENTS/ OPERATION	3	4	5	6						M	B	C	
1.0	WELDER'S QUALIFICATION													
1.1	WELDING PROCEDURE SPECIFICATION (WPS)													
1.1.1		CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX		QW 482		P	V	V	
1.2	WELDER PERFORMANCE & PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS & WELDING PERFORMANCE	MA	PHYSICAL TEST	ASME IX	ASME IX	ASME IX		QW 483 & QW 484		P	V	V	
2.0	TANKS													
2.1	RAW MATERIAL :													
2.1.1	PLATE	CHEMICAL & PHY. PROPERTIES	MA	CHEM & PHY TEST	1/PLATE/HT BATCH	ASTM A 240 GR.TP 304	ASTM A 240 GR.TP 304		MFG.TC/LAB REPORT		P	V	V	IDENTIFICATION BY BHEL
2.1.2	PIPE FOR NOZZLE	IGC TEST	MI	IGC TEST	1/PLATE/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'		MFG.TC/LAB REPORT		P	V	V	
2.1.2		CHEMICAL & PHY. PROPERTIES	MA	CHEM & PHY TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304		MFG.TC/LAB REPORT		P	V	V	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT		MFG.TC/LAB REPORT		P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'		MFG.TC/LAB REPORT		P	V	V	
2.1.3	FLANGES FOR TANKS	HYDRO TEST	NA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE		MFG. TC/IR		P	V/W	V	REFER NOTE 4
2.2	IN PROCESS	CHEMICAL & PHY PROPERTIES	MA	CHEM & PHY TEST	1/HT BATCH	ASTM A 182 GR. F 304	ASTM A 182 GR. F 304		MFG. TC/LAB REPORT		P	V	V	
2.2.1	DISHED ENDS	DIMENSIONS	MA	MEASUREMENT WITH TEMPLATE	100%	APPD. DWG. (BY BHEL)	APPD. DWG. (BY BHEL)		MFG.TC./LAB REPORT		P	V	V	
		SURFACE DEFECTS ON WELDMENTS		DP TEST	100%	ASTM E 165	NO SURFACE DEFECTS		MFG.TC		P	V	V	
2.3	FINAL ASSEMBLY FOR TANKS:	DIMENSIONS &	MA	MEASUREMENT	100%	APPD. DWG. (BY BHEL)	APPD. DWG. (BY BHEL)		MFG.TC/INSP REPORT		P	W	W	TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY
		ORIENTATION	MA	VISUAL	100%	APPD. DWG. (BY BHEL)	APPD. DWG. (BY BHEL)		MFG.TC/INSP REPORT		P	W	W	INSPECTION.
2.3.1		LEAKAGE	MA	WATER FILL FOR 2 HR	100%	N.A.	NO LEAKAGE		MFG.TC/INSP. REPORT		P	W	W	
3.0	STIRRER :													
3.1	RAW MATERIAL FOR SHAFT	CHEM.& PHY. PROPERTIES	MA	CHEM & PHY TEST	1/BAR	ASTM A 479 GR.TP 304	ASTM A 479 GR.TP 304		MFG.TC/LAB REPORT		P	V	V	
3.2	IMPELLER	IGC TEST	MA	IGC TEST	1/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'		MFG.TC/LAB REPORT					
3.2	COMPLETE STIRRER UNIT WITH MOTOR	CHEMICAL PROP.	MA	CHEMICAL TEST	1/PLATE	ASTM A 240 GR.TP 316	ASTM A 240 GR.TP 316		MFG.TC/LAB REPORT		P	V	V	
3.3		PERFORMANCE IN WATER FILLED TANK												
		- VIBRATION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET		MFG.TC		P	V	V	
		- WOBBLING	MA	VISUAL	100%	NO WOBBLING	NO WOBBLING		MFG.TC		P	V	V	
		- POWER CONSUMPTION/ CURRENT												
		DRAWN	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET		MFG.TC		P	V	V	
4.0	MOTORS:	ROUTINE TEST	MA	MFG. TC	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET		MFG.TC		P	V	V	
		TYPE TEST	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET		MFG.TC		P	V	V	
		DEGREE OF PROTECTION	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET		MFG.TC		P	V	V	
			** LEGEND :											
			M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR											
			B : BHEL/NOMINATED INSPECTION AGENCY											
			"P" PERFORM, "W" WITNESS, AND "V" VERIFICATION											
			C: CUSTOMER											
			SIGNATURE											
			SIGNATURE OF APPROVAL BY CUSTOMER											
MANUFACTURER/ SUB CONTRACTOR			MAIN SUPPLIER–BHEL											

ANNEXURE-1

MANUFACTURER'S NAME & ADDRESS :			QUALITY PLAN QP.NO : PE-VO-423-154A-006 REV. : 0 DATE : <th colspan="3"> PROJECT PACKAGE CONTRACT NO. </th> <th colspan="3">1X800 MW COAL BASED NORTH CHENNAI TPP STAGE -III-BTG</th>			PROJECT PACKAGE CONTRACT NO.			1X800 MW COAL BASED NORTH CHENNAI TPP STAGE -III-BTG		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME & ADDRESS :			SUB - SYSTEM :			CHEMICAL DOSING SYSTEM			CHEMICAL DOSING SYSTEM		
MANUFACTURER'S NAME											

MANUFACTURER'S NAME & ADDRESS :				QUALITY PLAN				PROJECT				1X800 MW COAL BASED NORTH CHENNAI TPP STAGE -III-BTG CHEMICAL DOSING SYSTEM CONTRACT NO.		
ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM :				QP.NO : PE-VO-423-154A-006				PACKAGE CONTRACT NO.						
				REV. : 0										
				DATE :				3 OF 4						
CHEMICAL DOSING SYSTEM				PAGE :				MAIN SUPPLIER						
S.NO	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS					AGENCY**	
1	2	3	4	5	6	7	8	9				M	B	R
9.0	FITTING/FLANGES FOR PIPING:											10		
9.1	RAW MATERIAL	CHEM.& PHY PRPERTIES	MA	CHEM.& PHY TEST	1/HT BATCH	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT				P	V	V
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT				P	V	V
		IGC TEST	MI	IGC TEST	1/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'	MFG.TC/LAB REPORT				P	V	V
		DIMENSIONS	NA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	MFG.TC				P	V	V
9.2	FINAL INSPECTION													
STRAINERS :														
10.0	RAW MATERIAL FOR BODY	PHY.& CHEM. PROPERTIES	MA	PHY. & CHEM. TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
10.1	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
10.2		MESH SIZE	MA	MEASUREMENT	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
10.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC				P	V	V
		LEAKAGE		HYDRO TEST		1 BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC				P	V	V
11.0	PIPE (SEAMLESS)													
11.1	MATERIAL	CHEMICAL	MA	CHEMICAL	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT				P	V	V
		MECHANICAL TEST	MA	MECHANICAL TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT				P	V	V
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT				P	V	V
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT				P	V	V
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/IR				P	V/W	V
12.0	LEVEL GAUGE :													
12.1	RAW MATERIAL	CHEM. PROPERTIES	MA	CHEM. TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
12.2	FINAL INSPECTION	DIMENSION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC				P	V	V
		LEAKAGE	MA	HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC				P	V	V
13.0	PRESSURE & DP GAUGE													
13.1	MAT. FOR WETTED PARTS & BOURN	CHEM.PROPERTIES	MA	CHEM. TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
13.2	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT						
13.3	PERFORMANCE	ACCURACY & OVERLOAD PROTECTION	MA	CALIBRATION	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC				P	V	V
14.0	SWITCHES(LEVEL, PRESURE & DP) & TRANSMITTERS (LEVEL, PRESURE & DP):											INSTRUMENTS AS APPLICABLE FOR THE MODULE ORDERED SHALL BE CONSIDERED.		
14.1	MAT. FOR WETTED PARTS	CHEM.PROPERTIES	MA	CHEM. TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
14.2	PERFORMANCE	FUNCTIONAL	MA	CALIBRATION & VISUAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC				P	V	V
		IR-HV-IR		ELECTRICAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC				P	V	V
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC				P	V	V
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERT	TYPE TEST	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT				P	V	V
** LEGEND :														
M : MANUFACTURER/SUB-CONTRACTOR/SUB-VENDOR														
B : BHEL/NOMINATED INSPECTION AGENCY														
"P" PERFORM, "W" WITNESS, AND "V" VERIFICATION														
MANUFACTURER/ SUB CONTRACTOR		C: CUSTOMER												
		SIGNATURE												
		SIGNATURE OF APPROVAL BY CUSTOMER												

		MANUFACTURER'S NAME & ADDRESS :		ANNEXURE-1 QUALITY PLAN ITEM: : SUB - SYSTEM : CHEMICAL DOSING SYSTEM				PROJECT PACKAGE CONTRACT NO. CHEMICAL DOSING SYSTEM		1X800 MW COAL BASED NORTH CHENNAI TPP STAGE -III-BTG	
				Q.P.NO : PE-VO-423-154A-006 REV. : 0 DATE :							
				PAGE : 4 OF 4				MAIN SUPPLIER BHEL/PEM, NOIDA			
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY** M B R	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
15.0	CONTROL PANEL :	DIMENSIONS CONTINUITY, IR-HV-IR	MA MA	MEASUREMENT ELECTRICAL	100% 100%	BHEL APPD.DATA SHEET/DWG BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT INSPECTION REPORT	P W P W		
		VERIFICATION OF MAKE	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		RATING OF COMPONENTS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		PAINT SHADES, THICKNESS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		ADHESION	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERTIFICATE	TYPE TEST	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT	P V		
16.0	COMPLETE SKID ASSEMBLY:	DIMENSIONS & ORIENTATION	CR	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		LEAKAGE, CHECK ON WELDMENTS		VISUAL & HYDRO TEST	100%	DISCH.PIPING - 1.5 x DISCH PR. OF PUMP NO LEAKAGE		INSPECTION REPORT	P W		
		FUNCTIONAL TEST FOR INTERLOCKS	MA	VISUAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
		GRADE CONFIRMATION	MA	CHEM.TEST	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W		
	PML Test for SS	PAINTING	MA	VISUAL & MEASUREMENT	100%	BHEL APPD PAINTING SCHEME	APPD DWG/PAINTING	INSPECTION REPORT	P W		
NOTE-1) WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. MIN DISTANCE BETWEEN TWO DEFECTS SHALL BE 3 TIMES THE DIA OF BAR.											
NOTE-2) CHEMICAL DOSING SKID VENDOR SHALL BE SELECTED FROM CUSTOMER APPROVED SOURCES. ALL THE BOUGHT OUT ITEMS OF THE CHEMICAL DOSING VENDOR SHALL BE PROCURED FROM BHEL APPROVED SOURCES.											
NOTE-3) ALL VENDOR DRAWINGS/DATASHEET'S SHALL BE APPROVED BY BHEL. ONLY MANUFACTURING QP(PREPARED IN LINE WITH THIS STANDARD QP) OF THE VENDOR SHALL BE FORWARDED FOR CUSTOMER APPROVAL. ALL THE BHEL APPROVED DOCUMENTS SHALL BE FURNISHED TO CUSTOMER FOR INFORMATION/RECORDS ALONG WITH O&M MANUAL. COPY OF THE SAME SHALL ALSO BE FURNISHED TO INSPECTION AGENCY DURING INSPECTION.											
NOTE 4) FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORIZED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLAUSE 2.1.2 AND 10.0; HOWEVER FOR HYDRAULIC TEST, MANUFACTURER TC SHALL BE REVIEWED . IN CASE ON IMPORTED PIPES PURCHASED FROM OPEN MARKET, TEST SHALL BE PERFORMED AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST).											
NOTE 5) FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL PRODUCERS ON BULK QUANTITIES, THEIR TEST CERTIFICATE SHALL BE REVIEWED (EXCEPT TIME TEMPERATURE CHART)											
NOTE 6) NDT REQUIREMENT ON WELDING (TANK, PIPE, BREATHER/WATER SEAL/CO2 ABSORBER) SHALL BE AS -- A) ON BUTT WELD-- 25% DP & 25% RT FOR PUMP SUCTION SIDE & 100% DP & 100% RT FOR PUMP DISCHARGE SIDE. B) ON FILLET WELD--100% DP TEST											
				** LEGEND :							
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION		C:CUSTOMER				SIGNATURE OF APPROVAL BY CUSTOMER	
SIGNATURE											

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP	SPECIFICATION NO. PE-TS-423-154A-A001
	STAGE –III-BTG	SECTION -I
	TECHNICAL SPECIFICATION FOR	SUB SECTION - IA
	CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

Bidder to also follow the additional Quality requirements as mentioned below for LP chemical Dosing system in addition to QP enclosed above:

LP CHEMICAL DOSING SYSTEM:

- 1) Pumps of chemical doing system shall be performance tested as per relevant international codes.
- 2) In case of diaphragm type of pumps, the life cycle test shall be done on pumps. If this test is already conducted for same model in earlier projects of TANGEDCO, then TCs for same shall be reviewed.
- 3) Dosing skid shall be subjected to leakage test and functional test.

	TITLE:		SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP		SECTION I
	STAGE –III-BTG		SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR		REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM		

ANNEXURE II:
SUB VENDORS LIST



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
2.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
3.	HORIZONTAL CENTRIFUGAL PUMPS	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.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
		HILLER	-	
4.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
5.	BUTTER-FLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

		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	
6.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
7.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI ,CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
8.	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTRATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
9.	RUBBER FLAP TYPE CHECK VALVES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
10.	SOLENOID VALVES	ROTEX	-	
		AVCON	-	
11.	SS PIPES / TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
		TORRENT CABLE	NADIAD	
		UNIVERSAL CABLES	SATNA	
		GEMSCAB	BHIWADI	
		DELTON	FARIDABAD	
12.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
13.	FRP TANKS & FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
14.	EJECTOR	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
15.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
16.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
17.	Y TYPE STRAINER	JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
18.	ORIFICE PLATE	MICRO PRECISION	FARIDABAD	
		INSTRUMENTAION LTD	PALGHAT	
		CARLO DYNAMICS	HYDERABAD	
19.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
		FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABLE IN VD FILE.
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT- UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500, GLV-BBT- UPTO300NB CL UPTO600, SCNRV-BBT- UPTO600NB CL UPTO150, SCNRV-BBT- UPTO300NB CL 300, SCNRV-PSBT- UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900, GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300, GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
20.	SLUICE GATE	V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
		H SARKAR	KOLKATA	
21.	3 WAY VALVE	JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
		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	



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
22.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
23.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
24.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCORPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
25.	PAINT	BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
26.	PNEUMATIC ACTUATOR	PROCON ENGINEERS	-	
		TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
27.	MOTORISED ACTUATOR	ROTARK	-	
		AUMA	-	
		LIMITORK	-	

SUB-VENDOR LIST FOR LT MOTORS

SL NO.	VENDOR NAME	
1	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003
2	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.
3	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA
4	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032
5	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055
6	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR- 413003, MAHARASHTRA
7	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006
8	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045
9	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053
10	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA

SUB-VENDOR LIST FOR GLANDS

1	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA
2	ARUP ENGG & FOUNDRY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068
3	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI- 600018
4	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063
5	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
6	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059
7	INCAB	HARE STREET,KOLKATA, WEST BENGAL-700001

SUB-VENDOR LIST FOR LUGS

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-423-154A-A001

1	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
2	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001

C&I SUB-VENDOR LIST

LIST OF C&I VENDORS

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

7	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
8	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, - Kalamboli Taluka Panvel- MAHARASHTRA India Phone- 022- 27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
9	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar - GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
10	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
11	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI- MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
12	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com
13	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218- 230& 235, Industrial Estate,Makhupura, -Ajmer- RAJASTHAN India Phone- 9887865856, FAX : 0145- 2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com

14	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad- MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzner.endress.com
15	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business, Parsiwada, Sahar road, Andheri (East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1-> Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai- MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
16	TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1-> Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA, PHASE-I - NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011-26819440 Pincode : 110 020 Email : production@vautomat.com
17	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
18	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE- KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
19	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwiji Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1-> Mr. Kedar Tillu 53, 54, 56 & 57, Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com
20	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1-> Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI- MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :

21	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI- MAHARASHTRA INDIA Phone- 9619688001 FAX : 022- 66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com
22	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	
23	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	222, OKHLA INDUSTRIAL ESTATE, PHASE-II, NEW DELHI Phone- 9871799447 Pincode : 110020 Email : panel.marketing@cselectric.co.in	
24	LOCAL CONTROL PANELS	PYROTECH ELECTRONICS PVT. LTD.	E-329, ROAD NO.12, MIA, UDAIPUR Phone- 2492122,31,34 Pincode : 313003 Email : pyrotech@pyrotechindia.com	
25	LOCAL CONTROL PANELS	PROCON INSTRUMENTATION PVT. LTD.	1H, SHAKTI TOWERS, 766, ANNA SALAI, CHENNAI Phone- 28266041,2824142 Pincode : 600022 Email : procond1@nda.vsnl.net.in	
26	LOCAL CONTROL PANELS	INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	47, CHAKALA ROAD, ANDHERI(EAST), MUMBAI Phone- 28344494,28221532 Pincode : 400099 Email : indconapp@vsnl.com	



TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001

SECTION I

SUB SECTION - IA

REV.NO. 0 DATE :

NOTES:

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:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE III:

DRAWING DOCUMENTS DISTRIBUTION PROCEDURE



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

ANNEXURE -III

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS (sets)	NO. OF CD-ROMs (sets)
1	PLANT DEFINITION MANUAL-	-	3 CD-ROMs
2	Drawings "FOR APPROVAL"	10	Soft Copy
3	Drawings "FOR INFORMATION"	10	Soft Copy
4	Drawings "FINAL APPROVED DRAWING"	8	Soft Copy
5	Drawings "AS BUILT "	8	3 CD-ROMs
6	DATASHEETS,DESIGNCALCULATIONS,PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i) For Approval	10	Soft Copy
	ii) FINAL	8	3 CD-ROMs
	iii) Analysis reports of equipment/ piping/ structures components/ systems employing software packages as detailed in the specifications		
	a) Input	10	Soft Copy
	b) Output	10	Soft Copy
	c) Drawings/ Sketches	10	Soft Copy
7	Erection manual "FINAL"	8	3CD ROMS
8	Operation & Maintenance manual	10	3CD ROMS
9	Plant Hand Book "DRAFT"	6	SOFT COPY
10	Plant Hand Book "FINAL"	15	3CD ROMS
11	Commissioning and Performance Procedure manual	10	3CD ROMS
12	Performance and Functional Guarantees test report	6	3CD ROMS
13	Progress Reports	6	3CD ROMS
14	Project completion report	10	3CD ROMS
15	QA programme including Organization for implementation and QA system manual (with revision-servicing)	1	3CD ROMS
16	Vendor details in respect of proposed vendors including Bidder's evaluation report.		
17	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.		
	i) For review/comment	3	
	ii) For final approval	4	1 set CD ROMS
18	Welding Manual, Heat Treatment Manuals	4	
	Storage & preservation manuals Final Final	4	2 CD ROMS
19	Monthly Vendor Approval and QP approval status	2	1 CD ROM
20	QA Documentation Package for items / equipment manufactured and dispatched to site	2	2 CD ROMS
21	QA Documentation Package for field activities on equipment/systems at site	2	2 CD ROMS

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE –III-BTG	SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

Notes:

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying these requirements shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule (as applicable) in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/ MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/ MS-Excel/ MS-word of any other document as per the insistence of BHEL/ customer will also be submitted by the bidder without any delivery/ commercial implication to BHEL/ Customer.
 - P&IDs.
 - GA & Foundation Drawing
 - Local Control Panel/ Junction Box Wiring Diagram



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE IV:
PAINTING SPECIFICATION



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

ANNEXURE -IV

PAINTING

1.0 SCOPE

This section defines the technical requirements for surface preparation, selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The bidder shall submit a detailed painting procedure for approval of owner/ owner's representative after the award of contract.

The following surface and material shall require painting:

- All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
- All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
- All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting:

- Non-ferrous materials
- Austenitic stainless steel
- Plastic and / or plastic coated materials
- Insulated surface of equipment and pipes except colour coating wherever required.
- Painted equipment like blowers, pumps, valves etc. with finishing coats in good condition and with matching colour code.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job:

IS:5	Colours for ready mixed paints and enamel
IS:1303	Glossary of terms relating to paints
IS:2379	Colour code for identification of pipelines
IS:1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524 :	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS:2074	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	Ready mixed paint, brushing, Zinc Chrome, priming



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

IS:2932	Enamel Synthetic exterior (a) Undercoating (b) finishing
IS:4682	Code of practice for lining of vessels & equipment
SIS 559000	Swedish standard for blasting
ISO 8504-2	Preparation of steel substrates before application of paints and related products. Surface preparation methods Part 2 Abrasive blast cleaning
ISO 8501-1	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
SIS 05 5800	Surface preparation by acid pickling
SSPC SP08	Surface preparation by acid pickling
IS 2629	Recommended practice for hot dip galvanizing of iron and steel
ASTM A780	Standard practice for repair of damaged galvanized coatings
SSPC	Steel structures painting council
NACE	National association of Corrosion Engineers
DIN	Deutshes Institute for Normung
BS	British Standard
ASTM	American Society for Testing material
AWWA	American Water works association

3.0 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical derusters or rust converters shall not be applied. Acid cleaning is subject to approval of Purchaser/ Purchaser's representative.

3.1 BLASTING

The surface of the part/ component shall be blasted before the coating material is applied. Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air above 1100°C. Blasting activity shall be performed at temperatures 30°C above dew point and substrate temperature between 50°C & 500°C and relative humidity not exceeding 85% shall be maintained during painting. Necessary safety precautions for equipment and operator shall be adhered to and shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work. Abrasive used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives are chilled iron grit, shot steel, malleable iron grit and shots of non-metallic abrasive (aluminium oxide, copper slag, garnet etc.).

The grade of blasting shall be performed in line with the approved painting scheme. The nature, quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the required surface profile depth and cleanliness. Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

The grades of surface finish

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2½	Sa 2½	SP10	2
Commercial Blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting

- Blasting according to SIS 055900, Grade Sa 2½
- Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer coat shall be 15-25 µm.

3.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

3.3 Cleaning

Removal of impurity

Impurity	Removal
Dust, Loose deposits	Vacuum cleaning, brushing
Adhesive deposits	Power brushing
Oils, greasy impurities	Wet Blasting, Use of Detergent Additives by agreement
Salt deposits	Rinsing
Markings (eg felt up pen)	Organic solvents to manufacturer's specifications eg Trichloro trifluoro ethane and solvents containing acetone (renew solvent and rag frequently)

3.4 Acid Pickling

Prior to galvanizing the surface preparation shall be done by acid pickling as per SSPC-SP-08.

4.0 PROCESSING

4.1. General Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature 0C shall be + 5 and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3C above dew point.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

4.2. Application Procedure

The primer shall be applied by means of brush or by spary. The top coats shall be applied by means of brush, roller or spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

4.3. Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning according coating manufacturer's specification. The final top shall be reapplies completely.

4.4. Uncoated Surfaces

Moving parts of machines (e.g stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating up to a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

4.5. Bond Strength

The pill off stress determined using the pull off test method for adhesion shall not be less than 1.5 N/mm², according to ISO 4624.

5.0 SURFACE CONDITIONS OF COATING SURFACES

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

6.0 COATING SYSTEMS

6.1 General Requirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating this specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of top coats shall be in accordance with sub clause suggested colour codes for painting (Sub Clause 6.8)

6.2 Standard Coating System (External Coatings)

(a) Steel Surfaces

- i. All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.
- ii. Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

surface shall be abrasive blasted as explained in clause 3.1 to Sa 2½ finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.

- iii. Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.
- iv. Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- v. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

(b) Gratings and Step Threads

- i. Surface Preparation
Gratings and step threads shall be cleared by acid pickling as per SSPC-SP-08
- ii. Hot Dip galvanizing
The hot dip galvanizing shall be done as per IS 2629. The average mass of coating shall be 610 gm/m²
- iii. Post Treatment
Immediately after galvanizing post treatment such as chromating shall be applied to retard white rust attack.
- iv. Touch up mechanical damages
The repair of damages coatings shall be done as per the recommended practice ASTM A780.

6.3 Painting of Indoor components such as valves, pumps, motors, electrical parts, tanks etc.

At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

At Site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

6.4 Painting of Outdoor equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature up to 120°C as per clause 6.1 & 6.3.

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

6.5 Special Coating

(a) Parts exposed to temperatures above 120°C, up to 200°C, not insulated

i. At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½ and ISO 8501-1:1958. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

ii. At Site

Pre-treatment

Derusting of all mechanical damages, according to ISO 8501-1:1989, grade St 3 touch up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50µm.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Intermediate Coat

1 pack silicon acrylic dry film thickness 35 µm.

Final Coat

1 pack silicon acrylic, dry film thickness as 35µm. Total system dry film thickness 145µm. Final coat according to colour code

- (b) Parts exposed to temperatures above 200°C, up to 400°C, not insulated

i. **At Works**

Surface Preparation

Blasting according to ISO 8501-1:1958 grade Sa-2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

ii. **At Site**

Pre-treatment

Derusting of all mechanical damages, according to standard Sa 2½ to ISO 8501-1:1988. Touch up with coating system according to manufacturer's recommendations.

- (c) Insulated parts continuously exposed to condensing water or parts exposed to temperatures For parts that are provided with insulation on site.

i. **Insulated parts exposed to condensing water**

At Works

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm

ii. **Insulated parts exposed to temperatures**

Parts exposed to temperatures up to < 400°C

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used. Parts exposed to temperature above 400°C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and superheaters, reheaters etc)

Temporary Primer

Varnish



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

(d) Intermittent exposure due to condensing water/ chemicals (Indoors)

(i) **At Works**

Surface Preparation

Blasting according to Sa 2½ and ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two layers of Zinc phosphate primer, total dry film thickness 75µm.

(ii) **At Site**

Pre-treatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 50µm. Total system dry film thickness 205µm. When exposed o weathering, weather resistance finish coat shall be applied.

(e) Water Exposure

i. **At Site/ Works**

Pre-treatment

Removal of all welding pearls. Blasting according to Sa 3 to ISO 8501-1:1988

Coat

4 coats 2 pack coal tar epoxy, dry film thickness 125 µm each. Total system dry film thickness 500µm Touch up after erection as required.

6.6 Painting of Pipes

6.6.1. Buried Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note: All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- iii. Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982. The total thickness of the coating will not be less than 4.0 mm
- iv. Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm. Tests to be carried out after application: Bond/ Adhesion test, Holiday test

6.6.2. Overground Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns.
Note: All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

External surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

6.7 Internal Coatings

6.7.1. Tanks (Internal surfaces) as specified in relevant sections of specification

Industrial deionised, demineralised and potable water up to 60°C pH range 4.5-9.5 Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry film thickness >75µm.

Pre-treatment



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501- 1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat. In case of service or potable water tanks, the coating material selected shall not taint the water. The paint system shall confirm to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work. QA/ QC Procedure including pinhole inspection, shall be submitted for approval by Owner/ Owner's representative.

6.7.2. Rubber Lining of Pipes, Valves and Tanks for DM Water

Pre-treatment

Blasting according to Sa 2½ and ISO 8501-1:1988

Rubber Lining

Hard rubber 5 mm for DM water applications as IS – 4682

6.8 Painting for Electrical items

6.8.1. All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate/ oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing epoxy paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5/ RAL 7032 for all switchboard/ MCC/ Distribution boards, control panels etc.

6.8.2. All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.

6.8.3. Painting of I & C equipment: Epoxy coating required for all I & C equipment.

6.9 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2	Boiler casing, ducting	Nut Brown	413	-	-
3	Crane				
3.1	Crane structure	Golden Yellow	356	Black	-
3.2	Trolley & hook	Crimson	540	-	-



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
4	Fans, pumps, motors, compressors	Light Grey	631	-	-
5	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7	Switchgear	Light grey (Powder coated)		-	-
8	Control & relay panels	Light grey (Powder coated)	631/7078 of IS 1650	-	-
9	Turbines	Light grey	631	-	-
10	Generators & Exciter	Light grey	631	-	-
11	Transformers	Aluminium	-	-	-
12	Machinery guards	Signal red	537	-	-
13	Piping (without insulation and cladding)				
13.1	Water System				
a	Boiler feed	Sea Green	217	-	-
b	Condensate	Sea Green	217	Light Brown	410
c	DM Water	Sea Green	217	Light Orange	557
d	Soft Water	Sea Green	217	French Blue	166
e	Bearing Cooling Water	Sea Green	217	French Blue	166
f	Potable & filtered Water	Sea Green	217	French Blue	166
g	Service and clarified water	Sea Green	217	French Blue	166
h	Cooling water	Sea Green	217	French Blue	166
i	Sea Water	Sea Green	217	White	-
14	Ash Transmitting Vessels and pipe lines	Aluminium	-	-	
15	Air System				
15.1	Station air	Sky blue	101	-	-
15.2	Control air	Sky blue	101	White	-



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
16	Oil system				
16.1	Fuel oil	Light brown	410	French	166
16.2	Light oil (HSD)	Light brown	410	Brilliant green	221
16.3	Lubricating oil	Light brown	410	Light grey	631
16.4	Transformer oil	Light brown	410	Light orange	557
17	Gas System				
17.1	Carbon dioxide	Canary yellow	309	Light grey	631
17.2	Hydrogen	Canary yellow	309	Signal red	537
18	Fire services	Fire red	536	-	-
19	Effluent pipes	Black	-	-	-
20	Vacuum pipes	Sky blue	101	Black	-

Notes:

1. This colour code basically refers to IS: 2379 for piping with necessary modifications
2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.



TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE V:
MANDATORY SPARES LIST



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

MANDATORY SPARES LIST (MECHANICAL & ELECTRICAL)

Sr. no.	Description of Item	Unit	Quantity
1.0	LP CHEMICAL DOSING SYSTEM		
1	Dosing pumps & drive	No	1 no for each type & size
2	Agitator	No	1 no for each type & size
2.0	ELECTRICAL		
2.1	415 V Motors		
i)	Terminal plates	Nos.	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
ii)	Heaters	Set	2 sets
iii)	Greasing arrangements	Set	4 sets each type of motor
iv)	Motor of each type and rating	%	10% of the installed quantity or minimum 1 number whichever be higher.
v)	Bearings (DE and NDE) for each type and rating of motor	Set	4 sets

1X800 MW COAL BASED SUPERCRITICAL NORTH CHENNAI TPP STAGE - III**MANDATORY SPARES****Part 5.3: Control & Instrumentation**

SI No	Name/ Description of Spares	Unit	Qty
	Bidder shall include a minimum of 20 % spares for replacement of each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system offered by him even if this is not detailed below.	Chemical Dosing	
i)	Measuring Instruments - Indicators, Recorders, Electrical Metering and Skid Mounted Instruments		
1	10% of the number of indicators, recorders and meters offered from each model for the project or a minimum of one number per model, whichever is more. These instruments shall be supplied with three sets of blank scales.	Chemical Dosing	
2	For skid mounted instruments (if any) - 10% of total number of instruments for each model and type for the project or a minimum of one number for each model and type, whichever is more.		
(ii)	10% of total number of Temperature Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc. offered for each model and type for the project or a minimum of one number, whichever is more.	Chemical Dosing	
vi)	Relay Based Control Panels		
1	10% LEDs for indicating lights shall be furnished.	Chemical Dosing	
2	Three times, the one hundred percent (300% of installed) spare replacement control circuit fuses/MCB/MCCB of each current rating required shall be furnished.		
3	20% spare replacement relays modules & contactors of each type.		
vii)	Alarm Annunciation System		
1	20% spares of each type installed shall be provided for logic modules, group card modules, power supply modules, Hooters and any other electronic module.		

2	5% spares of each size shall be provided for un-engraved window boxes complete with LED etc.	Chemical Dosing	
3	20% of installed LEDs for annunciation facia windows and LEDs box assemblies offered for the project shall be provided as mandatory spares.		
4	One (1) spare annunciator hooter of each type.		
viii)	Erection hardware		
1	Ten (10) percent of each type & Size installed instrument valve, manifold for each type, rating, model number and size of devices supplied for the project.	Chemical Dosing	
2	Ten (10) percent of total number of condensate pots or four numbers whichever is higher of each type & Size installed.		
3	Ten (10) percent of each type & Size installed Fittings		
xviii)	Interchangeability & Packing		
	All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. 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 desiccators packs as necessary.		
xix)	Identification	Chemical Dosing	
	Each spare shall be clearly marked and labelled on the outside of the packing with its 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 of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.		
xx)	Contract-Quantities		
	The quantities & mandatory spares shall be as specified herein. Any other mandatory spares not listed above however required for any instrumentation item shall also be supplied by bidder. The final quantities may require addition/deletion during the contract stage. The Bidder shall furnish unit price for each mandatory spare under appropriate schedules which shall be used for adjusting the contract price in the event of addition/deletion from contract quantities specified herein.	Chemical Dosing	
xxi)	Documentation		
	Bidder shall furnish detailed catalogue, part number and subassembly/assembly drawings with manufacturer's cross reference for each spare part. The data and information furnished shall be of nature and content as per owner's approval to enable owner procurement of these spare parts directly from the respective manufacturer.		

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE –III-BTG	SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

Note:

- 1) **Interchangeability & Packing:** All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. 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 desiccators packs as necessary.
- 2) **Identification:** Each spare shall be clearly marked and labelled on the outside of the packing with its 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 of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.
- 3) **Contract-Quantities:** The quantities & mandatory spares shall be as specified herein. Any other mandatory spares not listed above however required for any instrumentation item shall also be supplied by bidder.
- 4) **Documentation:** Bidder shall furnish detailed catalogue, part number and subassembly/assembly drawings with manufacturer's cross reference for each spare part. The data and information furnished shall be of nature and content as per owner's approval to enable owner procurement of these spare parts directly from the respective manufacturer.
- 5) All the Mandatory 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.
- 6) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- 7) In case, mandatory spares are not applicable as per equipment / item selected, bidder has to provide equivalent mandatory spare as per for selected equipment / item in line with list of mandatory spares.
- 8) In case mandatory spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities in line with list of mandatory spares.



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE VI:

LIST OF ERECTION & COMMISSIONING SPARES



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

SL. NO.	ITEM DESCRIPTION	Quantity per skid (No.)	TOTAL NOS.
A.	AMMONIA DOSING SYSTEM		
1.0	Oil Seals for drive end.	12	24
1.1	Gaskets for drive end	12	24
1.2	Guide ring for plunger.	12	24
1.3	Teflon rings for valves.	24	48
1.4	Level gauge glass	4	8
1.5	Back up fuse	3	6
1.6	Pilot lamp	2	4
1.7	Push Button	2	4
1.8	Control fuse	2	4
1.10	Bulb for Annunciation	4	8
B.	HYDRAZINE DOSING SYSTEM		
1.0	Oil Seals for drive end.	12	24
1.1	Gaskets for drive end	12	24
1.2	Guide ring for plunger.	12	24
1.3	Teflon rings for valves.	24	48
1.4	Level gauge glass	4	8
1.5	Back up fuse	3	6
1.6	Pilot lamp	2	4
1.7	Push Button	2	4
1.8	Control fuse	2	4
1.9	Bulb for Annunciation	4	8
C.	NaOH DOSING SYSTEM		
1.0	Oil Seals for drive end.	4	4
1.1	Gaskets for drive end	4	4
1.2	Guide ring for plunger.	4	4
1.3	Teflon rings for valves.	8	8
1.4	Level gauge glass	1	1
1.5	Back up fuse	3	3
1.6	Pilot lamp	2	2
1.7	Push Button	2	2
1.8	Control fuse	2	2
1.9	Bulb for Annunciation	4	4

Note: -

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



TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE VII

DRAWING / DOCUMENTS SUBMISSION SCHEDULE

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE –III-BTG	SUB SECTION - IA
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

DRAWING/DOCUMENTS SUBMISSION SCHEDULE

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

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

- Drawing/documents submission schedule: First submission of basic drawings/ documents – (P&ID, GA & Foundation details & QAP for CHEMICAL DOSING SYSTEM) shall be within 3 weeks from the date of LOI.
- Every revised submission incorporating comments – within 7 days.
- BHEL shall provide observation / approval within 3 weeks from the date of document submission.
- Bidder further confirmed that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. . Engineering meeting shall be held fort nightly, for which the bidder shall depute his concerned engineer along with project manager to BHEL PEM office or at customer office. The meeting can also be held at site.

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

S.No.	Drawing/Document No.	Drawing/Document Title	No. of weeks for drawing/document submission after placing LOI/PO
1.	PE-V2-423-154A-A001	P&I DIAGRAM FOR CHEMICAL DOSING SYSTEM	3
2.	PE-V2-423-154A-A002	TECHNICAL DATA SHEET--CHEMICAL DOSING SYSTEM	5
3.	PE-V2-423-154A-A003	GA DRAWING & FOUNDATION DETAILS	3
4.	PE-V2-423-154A-A004	LOCAL CONTROL PANEL (INCLUDING WIRING DIAGRAM, LOGIC DIAGRAM AND FIELD TERMINATION DETAILS)- CDS	5
5.	PE-V2-423-154A-A005	ELECTRICAL LOAD DATA	5
6.	PE-V2-423-154A-A006	QAP FOR CHEMICAL DOSING SYSTEM	3
7.	PE-V2-423-154A-A007	O&M MANUAL FOR CHEMICAL DOSING SYSTEM WITH CATALOGUE	8
8.	PE-V2-423-154A-A008	PACKING & FORWARDING DETAILS	8

NOTES:-

- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION I SUB SECTION - IA REV.NO. 0 DATE :

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

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link
(<http://124.124.36.198/wrenchwebaccess/login.aspx>)
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>



TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE VIII:
FORMAT FOR OPERATION AND MAINTENANCE MANUAL



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

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

Check List for Operation & Maintenance Manual

- 3.1.1.1 **Project name** :
 3.1.1.2 **Project number** :
 3.1.1.3 **Package Name** :
 3.1.1.4 **PO reference** :
 3.1.1.5 **Document number** :
 3.1.1.6 **Revision number** :

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



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

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



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

ANNEXURE IX:
GENERAL TECHNICAL REQUIRMENTS



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

VOLUME II SECTION 1

CHAPTER 6

CONTENTS

1.0	INTRODUCTION	2
2.0	BRAND NAME	2
3.0	BASE OFFER & ALTERNATE PROPOSALS	2
4.0	COMPLETENESS OF FACILITIES	2
5.0	CODES & STANDARDS	2
6.0	EQUIPMENT FUNCTIONAL GUARANTEE	4
7.0	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS	4
8.0	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER	5
9.0	CENTRAL DOCUMENTATION FACILITY	17
10.0	QUALITY ASSURANCE PROGRAMME	18
11.0	PRE-COMMISSIONING AND COMMISSIONING FACILITIES	25
12.0	TAKING OVER	28
13.0	TRAINING OF OWNER'S PERSONNEL	28
14.0	SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION	29
15.0	NOISE LEVEL	29
16.0	PACKAGING AND TRANSPORTATION	29
17.0	ELECTRICAL ENCLOSURE	30
18.0	INSTRUMENTATION AND CONTROL	30
19.0	ELECTRICAL NOISE CONTROL	31
20.0	INSTRUMENT AIR SYSTEM	31
21.0	TAPPING POINTS FOR MEASUREMENTS	31
22.0	ELECTRONIC MODULE/COMPONENT DETAILS	31
23.0	ENVIRONMENTAL MONITORING & CONTROL MEASURES	31



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

CHAPTER 6 GENERAL TECHNICAL REQUIREMENTS

1.0 INTRODUCTION

This part covers technical requirements, which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.

2.0 BRAND NAME

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Owner to determine that the products proposed are equivalent to those named.

3.0 BASE OFFER & ALTERNATE PROPOSALS

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice may also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Owner. Sufficient amount of information for justifying such proposals shall be furnished to Owner along with the bid to enable the Owner to determine the acceptability of these proposals.

4.0 COMPLETENESS OF FACILITIES

4.1 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.2 All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.0 CODES & STANDARDS

5.1 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

codes of the Republic of India as well as of the locality where they will be installed, including the following:

- a. Bureau of Indian Standards (BIS)
- b. Indian electricity act
- c. Indian electricity rules
- d. Indian Explosives Act
- e. Indian Factories Act and State Factories Act
- f. Indian Boiler Regulations (IBR)
- g. Regulations of the Central Pollution Control Board, India
- h. Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- i. Pollution Control Regulations of Department of Environment, Government of India
- j. State Pollution Control Board.
- k. Rules for Electrical installation by Tariff Advisory Committee (TAC).
- l. Any other statutory codes / standards / regulations, as may be applicable.

5.2 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- a. Japanese Industrial Standards (JIS)
- b. American National Standards Institute (ANSI)
- c. American Society of Testing and Materials (ASTM)
- d. American Society of Mechanical Engineers (ASME)
- e. American Petroleum Institute (API)
- f. Standards of the Hydraulic Institute, U.S.A.
- g. International Organisation for Standardization (ISO)
- h. Tubular Exchanger Manufacturer's Association (TEMA)
- i. American Welding Society (AWS)
- j. National Electrical Manufacturers Association (NEMA)
- k. National Fire Protection Association (NFPA)
- l. International Electro-Technical Commission (IEC)
- m. Expansion Joint Manufacturers Association (EJMA)
- n. Heat Exchange Institute (HEI)

5.3 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, along with the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

5.4 As regards highly standardized equipment such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.

- 5.5 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
- 5.6 Two (2) English language copies of all-national and international codes and/or standards used in the design of the plant, equipment, civil and structural works shall be provided by the Bidder to the Owner within two calendar months from the date of the Notification of Award.
- 5.7 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Owner shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Bidder to bring to the notice of the Owner such changes and advise Owner of the resulting effect.

6.0 EQUIPMENT FUNCTIONAL GUARANTEE

- 6.1 The Equipment and Auxiliaries shall be capable of continuous operation in frequency range of 47.5 to 51.5 Hz.
- 6.2 The functional guarantees of the equipment under the scope of the Contract is given elsewhere in the technical specification. These guarantees shall supplement the general functional guarantee provisions covered under General Conditions of Contract.
- 6.3 Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Bidder as specified elsewhere in this specification.

7.0 DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.1 Design of Facilities

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Bidder shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinate performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.2 Maintenance and Availability Considerations

Equipment/facilities offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the Bidder for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities. 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 and accessories covered under the specification.

8.0 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER

8.1 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope. The Bidder shall furnish engineering data/drawings in accordance with the schedule of information as specified in Technical Specification and data sheets.

8.2 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I of this chapter.

8.3 The documentation that shall be provided by the Bidder is indicated in various sections of specification. The documentation shall include but not be limited to the following:

a. Basic Engineering Documentation

Prior to commencement of the detailed engineering work, the Bidder shall furnish a Plant Definition Manual within 4-6 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

- i. System description of all the mechanical, electrical, control & instrumentation & civil systems.
- ii. Technology scan for each system / sub-system & equipment.
- iii. Selection of appropriate technology / schemes for various systems/ Selection subsystems including techno-economic studies between various options.
- iv. Optimization studies including thermal cycle optimization.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- v. Sizing criteria of all the systems, sub-systems including various piping systems/ equipment/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.
- vi. Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.
- vii. Operation Philosophy and the control philosophy of the Main Plant and other plants.
- viii. General Layout plan of the power station incorporating all facilities General in Bidder's as well as those in the Owner's scope. This drawing shall also be furnished in the form of floppy discs to the Owner for engineering of areas not included in Bidder's scope.
- ix. Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the Bidder.
- x. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xi. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Owner.
- xii. After approval of Plant Definition Manual / Design Basis Report, Bidder shall furnish detailed technical specification of all system / packages of the Plant.

b. Detail Engineering Documentation

- i. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.
- ii. Flow diagrams, Process & Instrumentation Diagrams along with write-up and system description.
- iii. Start-up curves for turbine, boiler and both turbine and boiler combined together as a unit for various start-ups, viz. cold, warm and hot start-up.
- iv. Piping isometric, composite layout and fabrication drawings.
- v. Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.
- vi. Technical data sheets for all bought out and manufactured items. Bidder shall use the specifications as a base for placement of orders on their sub-vendors.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vii. Detailed design calculations for components, system/sub-system, piping etc., wherever applicable including sizing calculations for all auxiliaries as per criteria specified elsewhere in specification.
- viii. Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.
- ix. Transient, hydraulic and thermal stress analysis of piping and Transient, system wherever applicable & input and output data along with stress analysis isometrics showing nodes
- x. Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).
- xi. Characteristic Curves / Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.
- xii. Comprehensive list of all terminal points which interface with Owner's facilities giving details of location, terminal pressure, and temperature, fluid handled & end connection details, forces, moments etc.
- xiii. Power Supply single line diagram, block logics, control schematics, electrical schematics, etc.
- xiv. Protection system diagrams and relay settings.
- xv. Interconnection diagrams.
- xvi. Cable routing plan.
- xvii. Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, and installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
- xviii. Alarm and annunciation list and alarms & trip set points.
- xix. Sequence and protection interlock schemes.
- xx. Type test reports and power system stability study report.
- xxi. Control system configuration diagrams and card circuit diagrams and maintenance details.
- xxii. Detailed software manuals & source software listing.
- xxiii. Detailed flow chart for digital control system.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xxiv. Mimic diagram layout.
- xxv. Civil Task drawings (for the Engineering by Owner), Design and Drawings for the Civil & Structural works in the scope of the Bidder.
- xxvi. Model study reports wherever applicable.
- xxvii. Functional & guarantee test procedures and test reports.
- xxviii. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xxix. Documentation in respect of commissioning as listed out elsewhere in this specification.
- xxx. The Bidder while submitting the above documents / drawings for approval / reference as the case may be, shall mark on each copy of submission the reference letter along with the date vide which the submissions are made.

8.3.1 Instruction Manuals

The Bidder shall submit to the Owner, draft Instruction Manuals for all the equipment covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Owner the Instruction Manuals shall be submitted as indicated in Annexure-I of this chapter. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Owner. The Instruction Manuals shall comprise of the following.

8.3.2 Erection Manuals

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

- a) Erection strategy.
- b) Sequence of erection.
- c) Erection instructions.
- d) Critical checks and permissible deviation/tolerances.
- e) List of tool, tackles, heavy equipment like cranes, dozers, etc.
- f) Bill of Materials
- g) Procedure for erection.
- h) General safety procedures to be followed during erection/installation.
- i) Procedure for initial checking after erection.
- j) Procedure for testing and acceptance norms.
- k) Procedure / Check list for pre-commissioning activities.
- l) Procedure / Check list for commissioning of the system.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- m) Safety precautions to be followed in electrical supply distribution during erection

8.3.3 Operation & Maintenance Manuals

- i. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall be in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant / equipment including, operation, maintenance, dismantling and repair including periodical activities such as chemical cleaning of the generator. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Owner.
- ii. If after the commissioning and initial operation of the plant, the manuals require any modification / additions / changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Owner for records.
- iii. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.
- iv. The manuals shall include the following :
 - a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
 - b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.
 - c) Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.
- v. Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. system/equipment/assembly/sub- assembly - wise required for the complete plant.
- vi. On completion of erection, a complete list of bearings / equipment giving their location, and identification marks etc. shall also be furnished to the Owner indicating lubrication method for each type/category of bearing.

8.3.4 Plant Handbook

The Bidder shall submit to the Owner a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipment and systems covering the complete project including

1. Design and performance data.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Process & Instrumentation diagrams.
3. Single line diagrams.
4. Sequence & Protection Interlock Schemes.
5. Alarm and trip values.
6. Performance Curves.
7. General layout plan and layout of main plant building and auxiliary buildings.
8. Important Do's & Don't's
9. The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Owner's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.3.5 Project Completion Report

The Bidder shall submit a Project Completion Report at the time of handing over the plant.

8.3.6 Drawings

- a. All the plant layouts shall be made in computerized 3D modeling system. The Purchaser reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Purchaser's review shall be fully dimensioned and extracted from 3D model after interference check.
- b. All documents submitted by the Bidder for Owner's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-I. The soft copies to be supplied shall be either in CDs, or through direct transfer via E-mail, etc. depending upon the nature/volume/size of the document. The drawings submitted for approval could be in the Image form.
- c. Final copies of the approved drawings shall be submitted on CD-ROM along with the requisite number of hard copies as per Annexure-I.
- d. The completed plant documentation including integrated 3-D model with equipment drawings, data sheets, P&ID, BOQ, schematics, logic diagrams, test reports and quality plan, etc. attached to the respective equipment's / systems in the 3D model shall be furnished to Purchaser, along with the design review software which shall include interference check and walk-through animation, loaded on suitable hardware (server and work station). The software shall include facility for obtaining hard copies of all the drawings/documents on standard plotter / printer. The requisite hardware and software shall be supplied and commissioned by the Contractor at Purchaser's Engineering Office Complex as per mutually agreed schedule.
- e. All documents/text information shall be in latest version of MS Office.
- f. All drawings submitted by the Bidder including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

required for installation and interconnections with other equipment and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.

- g. Each drawing submitted by the Bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, Consultant, name of the Project, system designation, the specifications title, the specification number, drawing/document number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
- h. The drawings submitted by the Contractor (or their sub-vendors) shall bear Purchaser's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Purchaser's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Purchaser's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract
- i. The Bidder shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Owner. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".
- j. Similarly, all the drawings/ documents submitted by the Bidder during detailed engineering stage shall be stamped "FOR APPROVAL" or "FOR INFORMATION" prior to submission.
- k. The furnishing of detailed engineering data and drawings by the Bidder shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Owner will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipment provided by others and external connections & dimensions which might affect plant layout. The review by the Owner should not be construed to be a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Owner / Project Manager shall not relieve the Bidder of any of his responsibilities and liabilities under this contract.
- l. After the approval of the drawings, further work by the Bidder shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.
- m. All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Bidder's risk. The Bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/system at a later date, the Bidder may do so, but such changes shall promptly be brought to the notice of the Owner indicating the reasons for the change and get the revised



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- drawing approved again in strict conformance to the provisions of the Technical Specification.
- n. Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Owner prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/representative of Owner based on requirements of such piping indicated in approved / finalized Flow Scheme / Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.
 - o. Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the Bidder well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.
 - p. As Built Drawings After final acceptance of individual equipment/system by the Owner, the Bidder will update all original drawings and documents for the equipment/ system to “as built” conditions.
 - q. Drawings must be checked by the Bidder in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Owner. In case drawings are found to be submitted without proper endorsement for checking by the Bidder, the same shall not be reviewed and returned to the Bidder for re- submission. The Bidder shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/drawings at site which are needed as an input to the engineering. The Bidder shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Owner’s scope and submit all necessary drawings/ documents for the same.
 - r. The Bidder shall submit adequate prints of drawing/data/document for Owner’s review and approval. The Owner shall review the drawings and return one (1) copy to the Bidder authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Bidder to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.
 - s. All engineering data submitted by the Bidder after final process including review and approval by the Owner shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Owner in writing.

8.4 Engineering Information Submission Schedule



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Owner. For this, the bidder shall furnish a detailed list of engineering information along with the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

- (a.) Information that shall be submitted for the approval of the Owner before proceeding further, and
- (b.) Information that would be submitted for Owner's information only.

The Engineering Information Schedule shall be updated month wise.

The schedule should allow adequate time for proper review and incorporation of changes/modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.5 Engineering Progress and Exception Report

8.5.1 Report giving the status of each engineering information including

- (a.) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission
- (b.) Drawings which were not submitted as per agreed schedule.

8.5.2 The draft format for this report shall be furnished to the Owner within four (4) weeks of the award of the contract, which shall then be discussed and finalized with the Owner.

8.6 Technical Co-Ordination Meetings(TCM)

8.6.1 The Bidder shall be called upon to organize and attend monthly Design/ Co- ordination Meetings with the Owner/Owner's representatives, Project Consultant during the period of contract. The Bidder shall attend such meetings at his own cost at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.

8.6.2 The Bidder should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Bidder shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Bidder will be reviewed by the Owner as far as practicable within three (3) weeks from the date of receipt of the drawing .The comments of the Owner shall then be discussed across the table during the above co-ordination Meetings wherein best efforts shall be made by both sides to ensure the approval of the drawing.

8.6.3 The Bidder shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Bidder shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 8.6.4 Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.
- 8.6.5 Any delays arising out of failure by the Bidder to incorporate Owner's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Bidder to alter the Contract completion date.
- 8.7 Design Improvements**
- The Owner or the Bidder may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.
- If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Bidder proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
- 8.8 Equipment Bases**
- A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Owner. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.
- 8.9 Protective Guards**
- Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.
- 8.10 Lubricants, Servo Fluids and Chemicals**
- 8.10.1. The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. Consumption of all these consumables during the initial operation and final filling after the initial operation shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers.
- 8.10.2. As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.
- Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

8.11 Lubrication

Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.

8.12 Material of Construction

All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilized for various components shall be those which have established themselves for use in such applications.

8.13 Rating Plates, Name Plates & Labels

- 8.13.1 Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non- corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Owner.
- 8.13.2 Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Owner or as detailed in appropriate section of the technical specifications.
- 8.13.3 Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear sides.
- 8.13.4 Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with epoxy. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.
- 8.13.5 Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support/hanger.
- 8.13.6 Valves, steam traps and strainers shall be identified by Owner's tag number of a metal tap permanently attached to non-pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.
- 8.13.7 Safety and relief valves shall be provided with the following :
 - (a.) Manufacturer's identification.
 - (b.) Nominal inlet and outlet sizes in mm.
 - (c.) Set pressure in Kg/cm² (abs).
 - (d.) Blowdown and accumulation as percentage of set pressure.
 - (e.) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

8.13.8 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

8.13.9 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system

8.14 Tools and Tackles

The Bidder shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder along with the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Bidder shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Bidder should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Owner.

8.15 Welding

If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipment to be performed by others the requirements shall be submitted to the Owner in advance of commencement of erection work.

8.16 Colour Code for all Equipment/ Piping/ Pipe Services

All equipment/ piping/ pipe services are to be painted by the Bidder in accordance with Owner's standard colour coding scheme, which will be furnished to the Bidder during detailed engineering stage.

8.17 Protection and Preservative Shop Coating

8.17.1 Protection

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be.

8.17.2 Preservative Shop Coating

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Transformers and other electrical equipment if included shall be shop finished with one or more coats of primer and two coats of high grade epoxy. The finished colours shall be as per manufacturer's standards, to be selected and specified by the Owner at a later date.

- 8.17.3 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Bidder after obtaining specific approval of the Owner regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Owner.
- 8.17.4 All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Owner.
- 8.17.5 All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Owner. Lube oil piping or carbon steel shall be pickled.
- 8.17.6 Painting for Civil structures shall be done as per relevant part of technical specification.

9.0 CENTRAL DOCUMENTATION FACILITY

Bidder shall provide a Central Documentation Facility in the room identified at TANGEDCO / Headquarters, which shall be designed to store all the technical documents, drawings, manuals, data sheets etc., as given in respective chapters of Technical Specifications. All the documents, data and manuals that are approved by TANGEDCO as well as other documents shall be sent to this facility, from where it is shall be further distributed to all the concerned departments of the project including contractor's authorized personnel. Complete computerized records shall be maintained in this facility for all the incoming and outgoing drawings as per the procedure to be mutually discussed and agreed between the Owner (TANGEDCO) and the contractor at the time of award of EPC contract. This room shall be equipped with adequate facilities for reading as well as duplication of the drawings, data sheets etc. these facilities shall include but not limited to the following for carrying out works related to this project exclusively at **TANGEDCO / HQ**:

- i. Three (3) Nos. work stations
- ii. Three (3) Nos. Laser Printer A4 Size Coloured
- iii. Two (2) Nos. Nos Laser Colour Plotters of A0 Size,
- iv. Two (2) Nos of Heavy Duty Photo Copier of A4 Size,
- v. Two (2) Nos of Heavy Duty Photo Copier of A4 Size with sorting facility

Specification for above Hardware shall be furnished in line with the specification considered in Control & Instrumentation Volume II Section 2 Part 2.3

Complete consumables for the above, with necessary racks (Min. 06 nos), Special Cabinets (Min. 06 nos made of 18 SWG sheet thickness) for Storage. Modular furniture, tables, chairs etc., shall be provided.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

10.0 QUALITY ASSURANCE PROGRAMME

10.1. The Bidder shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Bidder's works or at his sub-Bidder's premises or at the Owner's site or at any other place of work are in accordance with the specifications. Such programs shall be outlined by the Bidder and shall be finally accepted by the Owner/authorized representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001. A quality assurance programme of the Bidder shall generally cover the following:

- (a.) His organization structure for the management and implementation of the proposed quality assurance programme
- (b.) Quality System Manual
- (c.) Design Control System
- (d.) Documentation and Data Control System
- (e.) Qualification data for bidder's key personnel.
- (f.) The procedure for purchase of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- (g.) System for shop manufacturing and site erection controls including process, fabrication and assembly.
- (h.) Control of non-conforming items and system for corrective actions and resolution of deviations.
- (i.) Inspection and test procedure both for manufacture and field activities.
- (j.) Control of calibration and testing of measuring testing equipment.
- (k.) System for Quality Audits.
- (l.) System for identification and appraisal of inspection status.
- (m.) System for authorising release of manufactured product to the Owner.
- (n.) System for handling, storage and delivery.
- (o.) System for maintenance of records, and
- (p.) 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.

10.2. General Requirements - Quality Assurance

10.2.1 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 Bidder 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 Bidder's responsibility to draw up and implement such programme duly approved by the Owner. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Owner for approval. Schedule of finalisation of such quality plans will be finalised before award. Monthly progress reports on MQP/FQP submission/approval shall be furnished.

10.2.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

mentioned therein and quality practices and procedures followed by Bidder's/ Sub-Bidder's/ sub-supplier's Quality Control Organisation, 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. The Quality Plan shall be submitted on electronic media e.g. Compact Disc or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

- 10.2.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Bidder's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.
- 10.2.4 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 manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Owner shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Owner's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Owner in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner along with technical justification for approval and dispositioning.
- 10.2.5 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).
- 10.2.6 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
- 10.2.7 The Bidder shall submit to the Owner Field Welding Schedule for field welding activities in the enclosed format. The field welding schedule shall be submitted to the Owner along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
- 10.2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Owner. All welding/brazing procedures shall be submitted to the Owner or its authorised representative for approval prior to carrying out the welding/brazing.
- 10.2.9 All brazers, welders and welding operators employed on any part of the contract either in Bidder's/sub-Bidder works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Owner.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 10.2.10 Welding procedure qualification & Welder qualification test results shall be furnished to the Owner for approval. However, where required by the Owner, tests shall be conducted in presence of Owner/authorised representative.
- 10.2.11 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.
- 10.2.12 Unless otherwise proven and specifically agreed with the Owner, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
- 10.2.13 No welding shall be carried out on cast iron components for repair.
- 10.2.14 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
- 10.2.15 All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.
- All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.
- 10.2.16 The Bidder shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors bought out items (BOI). All the sub-Bidder proposed by the Bidder for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Bidder and finalised with the Owner, shall be subject to Owner's approval. The Bidder's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Owner for approval within the period agreed at the time of pre-awards discussion and identified in review category prior to any procurement. Monthly progress reports on sub- Bidder detail submission / approval shall be furnished. Such vendor approval shall not relieve the Bidder from any obligation, duty or responsibility under the contract.
- 10.2.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Owner, the Bidder's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-Bidder shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Owner and such approved



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Quality Plans shall form a part of the purchase order/contract between the Bidder and sub-Bidder. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Owner on the monthly basis by the Bidder along with a report of the Purchase Order placed so far for the contract.

- 10.2.18 Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their sub-Bidder's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.
- 10.2.19 The Bidder shall carry out an inspection and testing programme during manufacture in his work and that of his sub-Bidder's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Bidder shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
- 10.2.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Bidder in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
- 10.2.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
- 10.2.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/ authorised representative.
- 10.2.23 **Burn in and Elevated Temperature Test Requirement for Electronics Solid State Equipment**
All solid state electronic systems/equipment shall be tested as a complete system/equipment with all devices connected for a minimum of 168 hours (7 Days) continuously under energized conditions prior to shipment from manufacturing works, as per the following cycle.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours of the total 168 hours of testing, the ambient temperature shall be maintained at 50 deg.C. The equipment shall be interconnected with devices which will cause it to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10 deg.C above the ambient temp. at 50 deg.C.

Burn in Test Cycle

The 48 hours elevated temperature test shall be followed by 120 hours of burn in test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time. During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

In case the Bidder/ sub-Bidder is having any alternate established procedure of eliminating infant mortile components, the detail procedures followed by the Bidder/ sub- Bidder along with the statistical figures to validate the alternate procedure to be forwarded.

The Bidder/Sub-Bidder shall carry out routine test on 100% item at Bidder/sub-Bidder's works. The quantum of check/test for routine & acceptance test by Owner shall be generally as per criteria/sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check/test for routine / acceptance test shall be as agreed during detailed engineering stage.

10.3. QA Documentation Package

The Bidder shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick mark.

- 10.3.1 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-ROM may be issued not later than three weeks.

- 10.3.2 Typical contents of QA Documentation is as below:-

- a. Quality Plan
- b. Material mill test reports on components as specified by the specification and approved Quality Plans.
- c. Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
- d. Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- e. Heat Treatment Certificate/Record (Time- temperature Chart)
- f. All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- g. CHP / Inspection reports duly signed by the Inspector of the Owner and Bidder for the agreed Customer Hold Points.
- h. Certificate of Conformance (COC) wherever applicable.
- i. MDCC

10.3.3 Similarly, the Bidder shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

10.3.4 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

- (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.
- (b.) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
- (c.) If a decision is made despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.

10.3.5 Transmission of QA Documentation

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Owner. For the particular case of phased deliveries, the complete quality document to the Owner shall be issued not later than 3 weeks after the date of the last delivery of equipment.

10.4. Project Manager's Supervision

10.4.1 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section General Conditions of Contract, the Bidder shall proceed to comply with the Project Manager's decision.

10.4.2 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

- (a.) Interpretation of all the terms and conditions of these documents and specifications.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- (b.) Review and interpretation of all the Bidder's drawing, engineering data, etc:
- (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract.
- (d.) Inspect, accept or reject any equipment, material and work under the contract.
- (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates
- (f.) Review and suggest modifications and improvement in completion schedules from time to time, and
- (g.) Supervise Quality Assurance Programme implementation at all stages of the works.

10.5. Inspection, Testing And Inspection Certificates

- 10.5.1 The word 'Inspector' shall mean the Project Manager and/or his authorized representative and/or an outside inspection agency acting on behalf of the Owner to inspect and examine the materials and workmanship of the works during its manufacture or erection.
- 10.5.2 The Project Manager or his duly authorized representative and/or an outside inspection agency acting on behalf of the Owner shall have access 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 Bidder shall obtain for the Project Manager and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.
- 10.5.3 The Bidder shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the Bidder may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.
- 10.5.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
- 10.5.5 When the factory tests have been completed at the Bidder's or sub-Bidder's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Bidder 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.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 10.5.6 In all cases where the contract provides for tests whether at the premises or works of the Bidder or any sub-Bidder, the Bidder, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Bidder and shall give facilities to the Project Manager/Inspector or to his authorized representative to accomplish testing.
- 10.5.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed Quality Assurance Programme forming a part of the contract.
- 10.5.8 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 10.5.3- of this chapter, the Bidder shall furnish quarterly inspection programme indicating 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.
- 10.5.9 All inspection, measuring and test equipment used by Bidder shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by the Owner. Wherever asked specifically, the Bidder shall re-calibrate the measuring/test equipment in the presence of Project Manager/Inspector.
- 10.6. Associated document for quality assurance programme:**
- List of items requiring quality plan and sub supplier approval. (Annexure-III).
 - Status of items requiring Quality Plan and sub supplier approval. (Annexure- IV).
 - Field Welding Schedule (Annexure-V).
 - Manufacturing Quality Plan (Annexure-VI).
 - Field Quality Plan (Annexure-VII).
- 11.0 PRE-COMMISSIONING AND COMMISSIONING FACILITIES**
- (a.) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Owner and the Bidder for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Bidder's quality assurance programme as well as those included elsewhere in the Technical Specifications.
- (b.) The Bidder's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipment shall be operated integral with sub-systems and supporting equipment as a complete plant. It will be the responsibility of the Bidder to assess and furnish a list of all commissioning spares required for successful commissioning



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

of all the equipment covered under the contract. Such a list shall be furnished by the Bidder within 12 months from the date of LOA, separately for each equipment and shall be reviewed by the Owner and discussed for mutual agreement. The commissioning spares will be so identified as not to allow the trial operation to suffer for want of such commissioning spares. The identification of commissioning spares will not in any way relieve the Bidder of any of his responsibilities of satisfactory performance under the provisions of other conditions of contract. All the commissioning spares shall be deemed to be included in scope of the Bidder as a part of the respective equipment package at no extra cost to the Owner.

- (c.) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Owner six months prior to the respective implementations. The Owner will approve final verification of cleanliness.
- (d.) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
- (e.) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Owner's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] approved by the Owner.
- (f.) The Bidder during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.
- (g.) Bidder shall furnish the commissioning organization chart for review & acceptance of Owner at least eighteen months prior to the schedule date of synchronization. The chart should contain :
 1. Bio data including experience of the Commissioning Engineers.
 2. Role and responsibilities of the Commissioning Organisation members.
 3. Expected duration of posting of the above Commissioning Engineers at site.

11.1 Initial Operation

- a) On completion of all pre-commissioning activities / tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.
- b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c) The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.
- d) The Bidder shall intimate the Owner about the commencement of initial operation and shall furnish adequate notice to the Owner in this respect.
- e) Any loss of generation due to constraints attributable to the Owner shall be construed as Deemed Generation.
- f) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Bidder. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Bidder to the full satisfaction of the Owner to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for withholding the aforesaid permission.

11.2 Guarantee Tests

- a) The final test as to prove the Performance Guarantees shall be conducted at Site by the Bidder in presence of the Owner. The Bidder's Commissioning, Start-up, Purchaser shall make the unit ready to conduct such test. Such test will be commenced within a period of three (3) months after the successful completion of Initial Operations. Any extension of time beyond the above three (3) months shall be mutually agreed upon. These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee
- b) For performance/ demonstration tests instrumentations, of accuracy class, to the approval of the Owner shall be used. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Owner's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.
- c) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Bidder, free of cost.
- d) The Guarantee tests and specific tests to be conducted on equipment have been brought out in detail elsewhere in the specification.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

12.0 TAKING OVER

Upon successful completion of Initial Operations and all the tests other than guarantee tests conducted to the Owner's satisfaction, the Owner shall issue to the Bidder a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Owner delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Bidder of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

13.0 TRAINING OF OWNER'S PERSONNEL

- 13.1 The scope of service under training of Owner shall include a training module in the areas of Operation & Maintenance.

Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Owner:

- (a.) Training for Steam Generator Equipment
- (b.) Training for TG and related equipment.
- (c.) DDCMIS
- (d.) Training for Electric Power Supply systems
- (e.) Training for HT motor
- (f.) Training for power cycle piping/critical piping.

The above training shall be provided taken by the EPC Bidder in one of the reference power plant.

- 13.2 The scope of services under training shall also necessarily include training of Owner's Engineering personnel covering a training module of upto 52 man months. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Owner's Engineering personnel is attached as Annexure-II.

Four (4) man month and two (2) man month training for Purchasers Engineering Personnel on the offered CFD modelling code for SG & ESP including alternative geometry modelling technique to be provided.

- 13.3 Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Owner's approval. Consolidated training period included above (i.e. 35 and 52 man months respectively for O&M and Engineering) is indicative only. Owner reserves the right to



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

re-appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.

- 13.4 Clause 13.2 & 13.3 shall be applicable for domestic bidders. For foreign bidders refer Vol I, Section 2, GCC.
- 13.5 Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.
- 13.6 In all the above cases, wherever the training of Owner's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Owner's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.
- 13.7 Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Owner reserves the right to include or exclude these item(s) during place of Award. All expenses except travelling expenses shall be borne by the contractor.

14.0 SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

- a. Working platforms should be fenced and shall have means of access.
- b. Ladders in accordance with Owner's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

15.0 NOISE LEVEL

The equivalent 'A' weighted sound pressure level measured at a height of 1.0 m above floor level in elevation and at a distance of one (1) meter horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for

- (a.) Safety valves and associated vent pipes for which it shall not exceed 105 dBA.
- (b.) Regulating drain valves in which case it shall be limited to 90 dBA.
- (c.) TG unit in which case it shall not exceed 90 dBA.
- (d.) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 85 dBA.

16.0 PACKAGING AND TRANSPORTATION

All the equipment & spares 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. Each spare shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packaged in a single case, a general description of the contents shall be shown on the outside of such a case and other packages must be suitably marked and numbered for the purpose of identification. All cases, containers or packages, are liable to be opened for such examination as may be considered reasonable by the Engineer. In case of



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

equipment supplied with grease/lubricants from imported origin, the supplied shall clearly indicate the indigenous equivalent of the grease/lubricant and source of supply so as to enable the Owner to procure these items from indigenous sources. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Bidder shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting dispatch of equipment. Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & pre-assembly to bare minimum. The Owner's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

17.0 ELECTRICAL ENCLOSURE

All electrical equipment and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification.

18.0 INSTRUMENTATION AND CONTROL

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

- 18.1 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale. All scales and charts shall be calibrated and printed in Metric Units as follows:

a)	Temperature	Degree centigrade (deg C)
b)	Pressure	Kilograms per square centimeter (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
c)	Draught	Millimeters of water column (mm wc).
d)	Vacuum	Millimeters of mercury column (mm Hg) or water column (mm Wcl).
e)	Flow (Gas)	Tonnes/ hour
f)	Flow (Steam)	Tonnes/ hour
g)	Flow (Liquid)	Tonnes/ hour
h)	Flow base	760 mm Hg. 15 deg.C
i)	Density	Grams per cubic centimeter.

- 18.2 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 18.3 All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalized & components shall be of industrial grade or better.

19.0 ELECTRICAL NOISE CONTROL

The equipment furnished by the Bidder shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Bidder's equipment, which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.

20.0 INSTRUMENT AIR SYSTEM

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. shall be as per the details furnished elsewhere.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

21.0 TAPPING POINTS FOR MEASUREMENTS

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Bidder will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Bidder.

- (a.) Temperature test pockets with stub and thermowell
- (b.) Pressure test pockets

22.0 ELECTRONIC MODULE/COMPONENT DETAILS

The Bidder shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments, peripherals etc. It is mandatory for the Bidder to identify clearly the custom built ICs used in the package. The Bidder shall also furnish the details of any equivalents of the same.

23.0 ENVIRONMENTAL MONITORING & CONTROL MEASURES

Bidder to note that MOEF has declared Manali area as critically polluted area and also imposed certain restrictions on consideration of development of projects.

Concerned authorities have been addressed to have self-monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF and also to furnish the action plan ie., for the establishment of self-monitoring system. It is also directed to undertake



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Environmental Audit (EA) to ascertain the compliance level of standards notified by MOEF. In this context it is to be noted that our proposed project is also located in the said critically polluted cluster. Though environmental clearance for the said project has been obtained the Controlling Authorities will be highly keen and keep a tight vigil on the availability/provision of self monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF.

Environmental Clearance:

For Compliance of conditions stipulated by TNPCB under section 21 of the Air (Prevention and control of Pollution) Act 1981 as amended in 1987, the following are included in the specification:

- (a.) RCC chimney with designed height of 275mtrs included in the specification.
- (b.) High efficiency ESPs (99.9% efficiency) have been proposed to ensure emission of particulate matter within 50 mg/Nm³.
- (c.) Equipment for continuous monitoring of Ambient Air Quality has been proposed.
- (d.) On line / automatic continuous stack monitor has been proposed.
- (e.) Port holes in the chimney and sampling facilities for the stack for the proposed Boiler, as per the Central Pollution Control Board guide lines.
- (f.) The unit shall have suitable sufficient acoustic measures for Generator, Turbine, Coal crusher and other sources including special anti-vibration Foundation for which all the heavy rotating equipment / machines shall be erected over the Anti vibration foundations to reduce noise, vibration etc.,
- (g.) The unit shall have separate energy meter for the operation of the Electro Static Precipitator, the Air pollution control equipment for the proposed Boiler.
- (h.) Alternate power source will come into effect in case of power failure for
- (i.) the operation of Air Pollution Control measures laboratory for analysis of gaseous / particulate emissions
- (j.) The coal shall be stored in a completely paved area with the provisions for leach ate collection. The coal storage yard shall be provided with wind barriers of sufficient height. The height of the coal piles shall be lower than that of the wind barrier.
- (k.) The location of wind barriers shall be based on the predominant wind direction and shall be in consultation with TNPCB so as to avoid fugitive dust emission.
- (l.) Closed conveyors for coal transport and Bag filters in all the transfer points to control dust emission have been proposed
- (m.) Dust suppression system / water sprinklers to keep the stock pile sufficiently wet all the time to avoid carryover of dust.
- (n.) All the internal roads shall be well paved and be provided with water sprinkling arrangement to avoid fugitive dust emission during vehicle movement. The unit shall limit the speed of the vehicle to 10KM/hr. for heavy vehicles within the plant premises to prevent the road dust emission.
- (o.) Burners have been designed for low NO_x.
- (p.) Space provision made for installation of FGD of requisite efficiency of removal of SO₂, if required at a later stage for which adequate space is provided near the chimney.
- (q.) The unit shall ensure that the velocity of the exit gas from the stack shall be greater than 25 m/sec and the ratio of the exit gas to wind velocity shall not be less than 1.5 to eliminate or reduce pollutant down wash.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- (r.) The unit shall have on line/automatic continuous stack monitors with computer recording arrangement for monitoring SPM, Sox and Nox in the boiler emission.
- (s.) Sewage Treatment Plant & Effluent Treatment Plant has been proposed.
- (t.) Natural draft cooling tower has been included in the specification.
- (u.) 100% Dry fly ash collection system and conventional wet bottom ash disposal is included. However ash water recovery system is included in this scope if ash slurry is disposed in the ash pond in emergencies.
- (v.) Ash slurry pipe lines and ash water recovery pipe lines of adequate capacity and strength are proposed to be provided. However these pipe lines will be used only during emergency, since 100% dry fly ash collection is proposed.

Hence, it is stated that the implementation of Environmental measures including self-monitoring system (for air, Water and land) as per the EC granted, especially in the following areas have to be ensured by the bidder without any exception:

Continuous Air quality monitoring stations

Online monitoring system

Effluent Treatment plant

Sewage treatment plant

Optimum use of land area

100% Ash collection & utilisation

Green Belt Development.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

ANNEXURE-I

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS (sets)	NO. OF CD-ROMs (sets)
1	PLANT DEFINITION MANUAL-	-	3 CD-ROMs
2	Drawings "FOR APPROVAL"	10	Soft Copy
3	Drawings "FOR INFORMATION"	10	Soft Copy
4	Drawings "FINAL APPROVED DRAWING"	8	Soft Copy
5	Drawings "AS BUILT "	8	3 CD-ROMs
6	DATASHEETS,DESIGNCALCULATIONS,PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i) For Approval	10	Soft Copy
	ii) FINAL	8	3 CD-ROMs
	iii) Analysis reports of equipment/ piping/ structures components/ systems employing software packages as detailed in the specifications		
	a) Input	10	Soft Copy
	b) Output	10	Soft Copy
	c) Drawings/ Sketches	10	Soft Copy
7	Erection manual "FINAL"	8	3CD ROMS
8	Operation & Maintenance manual	10	3CD ROMS
9	Plant Hand Book "DRAFT"	6	SOFT COPY
10	Plant Hand Book "FINAL"	15	3CD ROMS
11	Commissioning and Performance Procedure manual	10	3CD ROMS
12	Performance and Functional Guarantees test report	6	3CD ROMS
13	Progress Reports	6	3CD ROMS
14	Project completion report	10	3CD ROMS
15	QA programme including Organization for implementation and QA system manual (with revision-servicing)	1	3CD ROMS
16	Vendor details in respect of proposed vendors including Bidder's evaluation report.		
17	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.		
	i) For review/comment	3	
	ii) For final approval	4	1 set CD ROMS
18	Welding Manual, Heat Treatment Manuals	4	
	Storage & preservation manuals Final Final	4	2 CD ROMS
19	Monthly Vendor Approval and QP approval status	2	1 CD ROM
20	QA Documentation Package for items / equipment manufactured and dispatched to site	2	2 CD ROMS
21	QA Documentation Package for field activities on equipment/systems at site	2	2 CD ROMS

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE****ANNEXURE-II****(Total within 52 man months)**

AREAS OF TRAINING REQUIREMENT			
PRODUCT	Product Design	Plant Visit	Visit To Manufacturer's Work
STEAM GENERATOR	Thermal design and hydraulic circulation balance	Familiarization with various system and equipment	Manufacturing processes of pressure parts, and equipment
	Combustion and Air & gas weight calculation	Performance data collection analysis and review	Welding process
	Pressure part calculation	O&M feed back	Testing facilities
	Pressure part and strength calculation	Operation history of various equipment and system	Product development in process
	Tube metal temp. calculation and selection. Performance calculation Duct design. Pressure part Equipment and system sizing and selection of mills, fans, air preheater, soot blowers, dampers, valves heater, soot blowers, dampers, valves, feeders, burners startup system, fuel firing system, draft plant Flow scheme development of air & flue gas, fuel oil, auxiliary steam, main and reheat steam feed water.	Failure analysis	Future plan for technology induction R&D work in progress
			Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues Familiarization of special maintenance technique Special tool and tackles familiarization

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MANDAYS CFD model development and validation for Steam Generator	Layout of over all plant, steam generator area, pressure part arrangements,platforms,equipment, piping and duct, coal pipe, flue gas ducts, bunker arrangement, valves and damper, ESP area, cable & piping tressels etc.			
	Erection strategies, erection procedures			
	Performance and demonstration tests.			
	120	20	20	20
	Familiarisation of fundamentals and basis for the development of the CFD models.			
	Solving of set of simple problems by Employer's engineers with the help of trainer.			
	Hands on experience on the development of detailed/realistic CFD models for the steam generator and ESP. The Bidder/trainer shall develop CFD models for SG & ESPs per the Contract requirement with complete association of the Owner's engineers.			

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Validation of the above CFD model for SG & ESP by Bidder in association with the Owner's Engineers.			
MANDAYS	120 for SG and 60 for ESP	-	-	-
TURBINE GENERATOR AND IT'S INTEGRAL AUXILIARIES	Turbine cycle optimization and turbine performance in off design condition.	Familiarization of power plants of various makes of turbines for super critical units	Manufacturing processes of turbine	
	Rotor design and strength calculation	Collection of data for analysis of availability of turbines	Assembly of turbine	
	Rotor dynamic behavior studies wrt natural frequency, critical speed, vibration etc.	Comparative studies for integral systems of turbine	Testing of turbines	
	Blade profile/root design and blade strength design, blade vibration analysis	O&M history/problems related to turbine	Product development in process	
	Casing & diaphragm design	Failure analysis	Future plan for technology induction	
	Labyrinth seal selection & design for different turbine configurations		R&D work in progress	
	Selection of turbine type (i.e. Tandem vs cross compounding, separate HP/IP vs combined HP/IP, material of construction etc.)			
	Design principle for Up rating/down rating of existing design/ modules for the specific project.			

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MANDAYS Boiler Feed Pumps	Selection of nos., type and arrangement of bearings, load calculation on bearings, bearing oil flow calculation Selection, design and control principle for Turbine governing system Performance calculation Steam path audit Layout principle of various equipment's of TG and its integral system Latest technological advancements			
	45	10	10	
	Techno-economic studies for Selection of BFP Configuration and its drive Criteria for selection of boiler Feed Pump parameters Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc Impeller design and its hydraulic behavior	Familiarization of power plants of various makes of feed pumps Data collection of BFP parameters and configuration Collection of data for analysis of availability of BFP O&M history/problems related to BFP	Manufacturing process of various components of BFP Assembly of BFP Testing, capabilities of BFP at works wrt performance, NPSH, thermal shock, dry run, visual cavitation, string test, axial thrust measurement Product development in process	

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit				
MANDAYS	Role of critical para- meters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps	Comparative studies for various types of BFP& its features			Future plan for technology induction	
	Material selection of BFP components Guiding factors for selection of BFP seals Computation of axial thrust under various flows Performance calculation Transient analysis in pump suction piping wrt NPSH margin Latest technological trends in BFP design				R&D work in progress	
	20	5			10	
Condenser	Selection of condenser type and its optimization wrt temp rise across condenser, pressure drop in condenser, surface area etc	Comparative studies of salient features			Manufacturing process of various components of condenser Assembly	
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality Condenser support selection & design	Collection of data for analysis of availability of Condenser O&M history/problems related to condenser			Testing capability at works Product development in process	

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work		
MANDAYS Feed Regenerative Equipment's	Sizing of condenser w.r.t. super critical units Latest technological trends in condenser arrangement and design Condenser vacuum system design		Future plan for technology induction R&D work in progress		
	10	5	5		
	Thermal and mechanical design calculation of heaters Basis of selecting horizontal/vertical heaters Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate Configuration of HP heaters (2x50% v/s100% capacity)	Comparative studies of salient features Analysis of data O&M history/problems related to heaters	Manufacturing process of various components of heaters Assembly Testing capability at works Product development in process		
	Sizing criteria for Deaerator/Heaters Selection of tube & tube sheet material of heaters Latest technological trends in heaters design		Future plan for technology induction R&D work in progress		
	15	10	10		
MANDAYS 3-dimensional CFD modeling	CFD model develop ment and validation of design data for steam turbine, BFP, CEP, condenser, heaters etc.				



1X800 MW COAL BASED NORTH CHENNAI THERMAL

POWER PROJECT STAGE III

EPC TENDER SPECIFICATION FOR BTG PACKAGE



PRODUCT	AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit				
MANDAYS	20					
Compressors	Equipment Theory & Maintenance Practice					
MANDAYS	16	-		4		
Condensate Polishing Unit	Equipment Theory & Maintenance Practice					
MANDAYS	15	5		5		
CONTROL & INSTRUMENTATION						
DDCMIS-Man Machine Interface - Hardware & Operating System	Hardware & Software organization of the system	Operational feedback				
	Basis of selection of H/W memory sizing					
	Operating system features, interface with other system, openness & inter- operability					
	Upgradability					
MANDAYS	System testing features	6			16	
DDCMIS-Man Machine Interface System Engineering & Application Software	Specific system customisation	Operation feedback				
	Various system					
	modules & interface with OS					
	Database organization & development					



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III
EPC TENDER SPECIFICATION FOR BTG PACKAGE**



PRODUCT	AREAS OF TRAINING REQUIREMENT				Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design						
	Development of mimics						
	Other application like calculations, logs historical storage functionalities & use						
MANDAYS	40	6			8		
DDCMIS - Control System Hardware	Basic design features for system & its modules	Operation feedback			Manufacturing processes special attention to handling of the modules Maintenance facilities		
	System capabilities & system design techniques						
	Communication with MMI & other system						
MANDAYS	24	5			10		
DDCMIS-Control system Application Software	Database structure Organisation & inter- face between application program & database	Operational feedback			System integration & System capabilities testing		
	Application for implementation of Control functions						
	Study of standard algorithms & development of new algorithms						
MANDAYS	18	4			4		
DDCMIS - Control Loop Study Loop Study	General description of closed loop controls of thermal power plant	Specific operational feedback					

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT				Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design						
	Critical analysis of few control loops e.g., TSCS Stress Control boiler startup control etc.						
MANDAYS	12	4					
DDCMIS-Burner Management System	Hardware logic, NFPA/ VDE requirements other safety standard	Operational feedback		Manufacturing procedure& precautions for handling the system			
	Flame scanner location			System testing facilities			
MANDAYS	16	6		6	12		
DDCMIS - EHTC, Turbine stress control system, Turbine protection system& ATRS	Basic design concept& features	Operational feedback		Manufacturing procedure & precautions for handling for handling the system			
	Logics of turbine stress control system		System testing facilities				
	Implementation of failsafe philosophy in turbine protection system						
MANDAYS	16	6		6	12		
Furnace and Flame Viewing System.	Theory & principle of operation	Operational feedback					
	Details of software & methods of modification/ customisation						
Misc. systems for SG/TG C&I							
MANDAYS	6	3					
VMS							

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
1) Hardware	Equipment Theory & Maintenance Practice			
MANDAYS	12	-	6	
2)Vibration Analysis	Equipment Theory & Maintenance Practice			
MANDAYS	12	-	6	
Analysar				
Water & Gas	Equipment Theory & Maintenance Practice			
MANDAYS	20	-	8	
PADO: System Engineering	Equipment Theory & Maintenance Practice			
MANDAYS	6	3	3	
PADO: Operation & Analysis	Equipment Theory & Maintenance Practice			
MANDAYS	18	6	-	
Actuators	Equipment Theory & Maintenance Practice			
MANDAYS	18	-	6	
Simulator	Equipment Theory & Maintenance Practice			
MANDAYS	16	-	4	
Networking / MIS	Equipment Theory & Maintenance Practice			

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT		AREAS OF TRAINING REQUIREMENT				Visit To Manufacturer's Work	Operation & Maintenance Of Plant
Product Design		Plant Visit					
MANDAYS	12		-		4		
Electric Power Supply System	Theory & design features				Manufacturing/assembly process		
					Testing methodology		
MANDAYS	5	2					
(ELECTRICAL) GENERATOR	(a) Design aspects of the following areas	Operational feed back			(a) Manufacturing process for		
	Insulation system	Familiarisation with different sub-systems			Core		
	Cooling medium & arrangement				Winding bars		
	Winding & core support systems				Assembly		
	b) Design aspects of other auxiliary systems				Testing facilities		
MANDAYS	30	15			15		
Generator Excitation System including AVR.	Design features of various sub-systems	Operational feed back			Manufacturing process& testing facilities for various equipment of excitation system		
	Excitor	Familiarisation with various equipment functioning at reference plants					
	PMG						
	Controllers & different limiters etc.						
	PSS & associated system studies						
MANDAYS	30	15			15		

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

PRODUCT	AREAS OF TRAINING REQUIREMENT			Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design					
Boiler Feed pump H.T. Motor	Design Criteria for the		Operational feed back		Manufacturing process & test facilities	
	Stator core & wdg					
	Rotor core & wdg					
	Insulation system					
	Cooling arrangement					
MANDAYS	20				5	
POWER TRANSFORMER	Equipment Theory & Maintenance Practice					
MANDAYS	12		-		4	4
UPS/BATTERY CHARGER	Equipment Theory & Maintenance Practice					
MANDAYS	8		-		4	4
CRITICAL PIPING & POWER CYCLE PIPING	Design familiarization for critical piping of supercritical Plant		Familiarization with feed back (in super critical plant) on failure analysis and vibration analysis of piping.		Cold Setting of spring hanger	
	Optimization study for sizing including pressure drop calculation and selection of single or double lead together with Owner's engineers		Study of Feed back regarding hanger setting strategies and practice		Cyclic tests carried on spring hangers.	
	Design and stress analysis of lines with Expansion Joints together with Owner's engineers				Cyclic tests carried on expansion joints	



1X800 MW COAL BASED NORTH CHENNAI THERMAL

POWER PROJECT STAGE III

EPC TENDER SPECIFICATION FOR BTG PACKAGE



PRODUCT	AREAS OF TRAINING REQUIREMENT			Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work	
	Design and stress analysis of piping systems with two phase flow involving Owner's engineers Transient analysis and optimum sizing of feed suction piping together with Owner's engineers. Static and dynamic analysis of critical piping including seismic and other occasional load analysis (safety valve blowing condition). A joint activity together with Owner's engineers. Study and collection of data pertaining to special welding requirements (pre and post weld heat treat ment and electrode selection criteria etc.) of materials used in high temp piping system. Study and collection of data on special requirements in case of welding dissimilar metals and electrode selection criteria		Manufacturing process of critical piping components and appreciation of their testing facilities at shop	
MANDAYS	5	2		

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE****ANNEXURE-III**

Project :		LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:			
Stage :							REV. NO. :			
Package :							DATE :			
Supplier :							PAGE : OF			
Bidder No :										
Sl. No.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status/ category	Sub-supplier Details submission schedule	Remarks

LEGENDS

1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY the Owner)
A – For these items proposed vendor is acceptable to the Owner. To be indicated with letter “A” in the list alongwith the condition of approval, if any.
DR – For these items “Detailed required” for the Owner review. To be identified with letter “DR” in the list.
NOTED – For these items vendors are approved by Main Supplier and accepted by the Owner without specific vendor approval from the Owner. To be identified with “NOTED.”

2. QP/INSPN CATEGORY:
CAT-I: For these items the Quality Plans are approved by the Owner and the final acceptance will be on physical inspection witness by the Owner.
CAT-II: For these items the Quality Plans approved by the Owner. However no physical inspection shall be done by the Owner. The final acceptance by the Owner shall be on the basis review of documents as per approved QP.
CAT-III: For these items Main Supplier approves the Quality Plans. The final acceptance by the Owner shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS: Place of manufacturing Place of Main Supplier of multi units/works.

LAHMEYER
INDIA

Spec. No.: SE/E/T& H(P) / OT No.02 / 2015- 16

**1X800 MW COAL BASED NORTH CHENNAI THERMAL****POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE****ANNEXURE-V**

Project :		FIELD WELDING SCHEDULE										DOC. NO.:				
Stage :		(To be raised by the Bidder)										REV. NO. :				
system:		Welding Code:										DATE :				
Bidder :												PAGE : OF				
Bidder No :																
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Dimensions	Process of welding	Type of Weld	WPS. No.	Min. pre-heat	Heat treatment		NDT method/Quantum	REF		Sub-suppliers approval status/category	Sub-supplier Details submission schedule	Remarks	
								Temp.	Holding time		Spec. No.	ACC Norm Ref.				
Notes:																
SIGNATURE																

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN							PROJECT:			
				SUB-SYSTEM:			ITEM :							
							QP NO.:							
							REV.NO.:							
							DATE:			PACKAGE:				
				PAGE: OF....			CONTRACT NO.:				MAIN-SUPPLIER:			
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS		
									M	C	N			
1	2	3	4	5	6	7	8	9	D*	** 10		11		
				LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.							DOC. NO.:			
				** M: MANUFACTURER/SUB-SUPPLIER							REV..... CAT.....			
				C: SUPPLIER/NOMINATED INSPECTION AGENCY, N: THE OWNER P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: THE OWNER SHALL IDENTIFIED IN COLUMN							FOR THE OWNER USE			
MANUFACTURER/ SUB-SUPPLIER		MAIN- SUPPLIER									REVIEWED BY		APPROVAL SEAL	
SIGNATURE														

MFGR.'s LOGO		SUPPLIER'S NAME AND ADDRESS		FIELD QUALITY PLAN				PROJECT:								
				SUB-SYSTEM:		QUANTUM OF CHECK	TYPE OF CHECK			CLASS# OF CHECK	CHARACTERISTICS/ INSTRUMENTS	ACTIVITY & OPERATIONS	SL. NO			
														ITEM :	QP NO.:	
																REV.NO.:
PAGE: OF ...		ACCEPTANCE NORMS	REFERENCE DOCUMENT	FORMAT OF RECORD	REMARKS											
1	2	3	4	5	6	7	8	9	10							
						LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (V) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS #: A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY THE OWNER FQA, 'B' SHALL BE WITNESSED BY OWNER'S ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY ERECTION SUPPLIER (A & B CHECK SHALL BE OWNER CHIP STAGE)		DOC. NO.: REV..... CAT								
MANUFACTURER/ SUB-SUPPLIER		MAIN- SUPPLIER				FOR THE OWNER USE		REVIEWED BY	APPROVED BY							
SIGNATURE									APPROVAL SEAL							

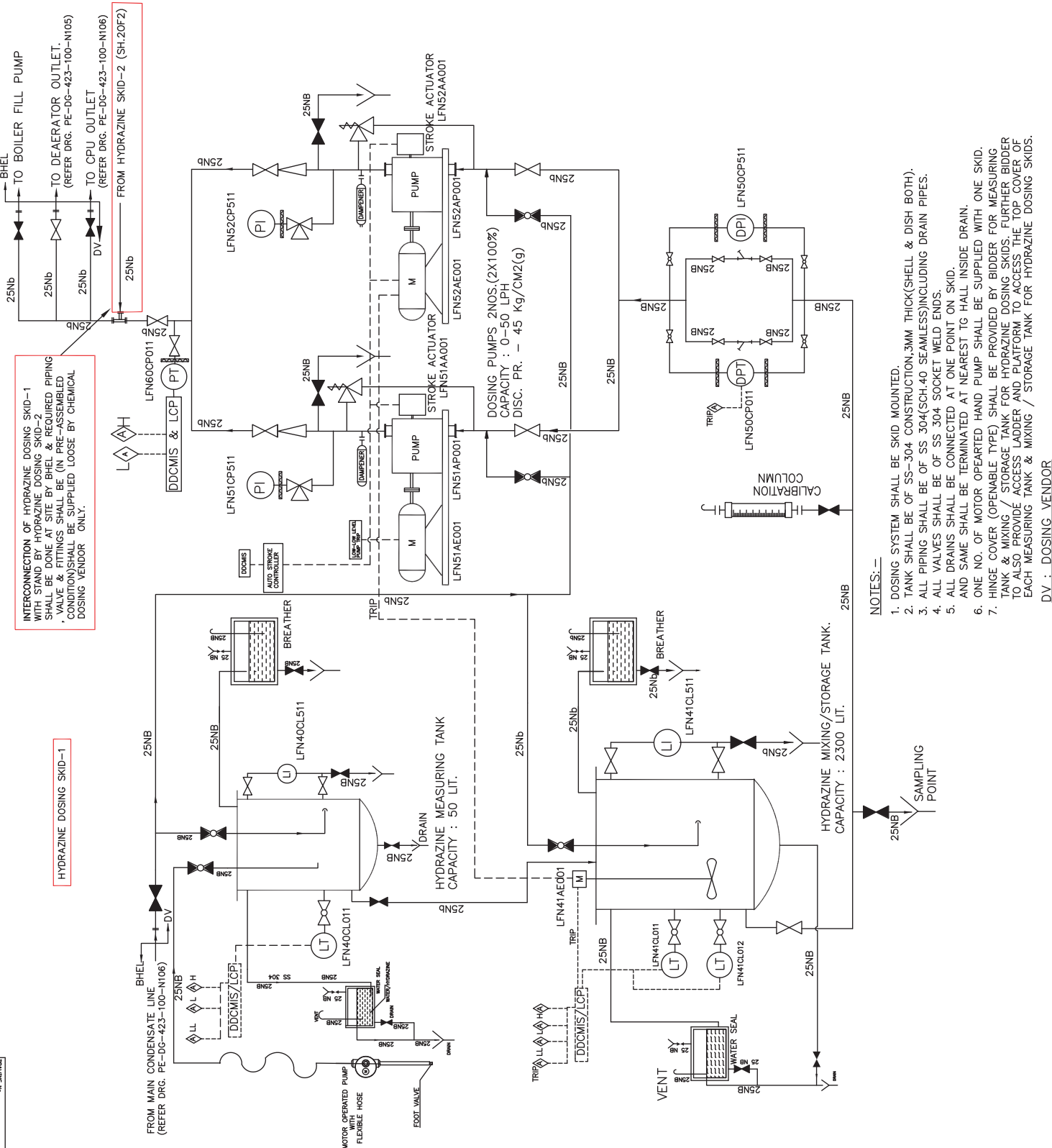


TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

P&ID

LENGE D



	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	THREE WAY VALVE
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE INDICATOR
	LEVEL INDICATOR
	MOTOR OPERATED (AC)
	GLOBE VALVE NORMALLY CLOSED
	LEVEL TRANSMITTER.
	Y-TYPE STRAINER
	DIFF PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE INDICATOR
	PRESSURE TRANSMITTER.
	LEVEL TRANSMITTER.
	DAMPNER
	CHEMICAL SEAL
	COUNTER FLANGE
	DISTRIBUTED DIGITAL CONTROL & MONITORING INFORMATION SYSTEM
	LOCAL CONTROL PANEL
	ALARM
	INTERLOCK
	MOTOR OPERATED PUMP
	TEE
	CALIBRATION COLUMN

[illegible]

NOTES:—

1. DOSING SYSTEM SHALL BE SKID MOUNTED.
2. TANK SHALL BE OF SS-304 CONSTRUCTION, 3MM THICK (SHELL & DISH BOTH).
3. ALL PIPING SHALL BE OF SS 304(SCH.40 SEAMLESS) INCLUDING DRAIN PIPES.
4. ALL VALVES SHALL BE OF SS 304 SOCKET WELD ENDS.
5. ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
6. AND SAME SHALL BE TERMINATED AT NEAREST TO HALL INSIDE DRAIN.
7. ONE NO. OF MOTOR OPERATED HAND PUMP SHALL BE SUPPLIED WITH ONE SKID.
8. HINGE COVER (OPENABLE TYPE) SHALL BE PROVIDED BY BIDDER FOR MEASURING TANK & MIXING / STORAGE TANK FOR HYDRAZINE DOSING SKIDS. FURTHER BIDDER TO ALSO PROVIDE ACCESS LADDER AND PLATFORM TO ACCESS THE TOP COVER OF EACH MEASURING TANK & MIXING / STORAGE TANK FOR HYDRAZINE DOSING SKID.

DV : DOSING VENDOR



1. DOSING S
2. TANK SH
3. ALL PIPIN
4. ALL VAL'
5. ALL DRAI
6. AND SAM
7. HINGE CO

ALKALI PREPARATION CUM DOSING TANK
CAPACITY : 500 LIT.



TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001

SECTION I

SUB SECTION - IA

REV.NO. 0 DATE :

DATASHEET-A



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

DATA SHEET- A

S. NO	DESCRIPTION	HYDRAZINE DOSING	AMMONIA DOSING	NaOH DOSING
1.0	NO. OF SKID(S) PER UNIT	Two (2)	Two (2)	One (1)
2.0	Chemical Used	Hydrazine	Ammonia	Sodium hydroxide
3.0	Chemical Concentration Used during operation	Wet laying -35% Normal operation - 0.6%	Wet laying -15% Normal operation - 30%	Normal operation - 5%
4.0	pH	Alkaline(>9)	Alkaline(>9)	Alkaline(>9)
5.0	Temp	Ambient	Ambient	Ambient
6.0	MEASURING TANK			
6.1	No. of tanks per Skid	One	One	NA
6.2	Capacity in litres	50	700	NA
6.3	Minimum free board	300 mm	300 mm	NA
6.4	Type	Vertical cylindrical, dish end bottom tank	Vertical cylindrical, dish end bottom tank	NA
6.5	Top cover	Hinge type	Hinge type	NA
6.6	Material of the tank	SS-304	SS-304	NA
6.7	Thickness	3 mm	3 mm	NA
6.8	Motorised Stirrer	NA	NA	NA
6.9	MOC -Dissolving basket	NA	NA	NA
6.10	MOC of stirrer (Shaft & propeller)	NA	NA	NA
6.11	Access ladder & platform	To be provided	To be provided	NA
7.0	MIXING CUM STORAGE TANK			
7.1	No. of tanks per Skid	One	One	One
7.2	Capacity in litres	2300	2300	500
7.3	Minimum free board	300 mm	300 mm	300 mm
7.4	Type	Vertical cylindrical, Bottom Dished end.	Vertical cylindrical, Bottom Dished end.	Vertical cylindrical, Bottom Dished end.
7.5	Top cover	Hinge type	Hinge type	Hinge type
7.6	Material of the tank	SS-304	SS-304	SS-304
7.7	Thickness of shell	3 mm	3 mm	3 mm
7.8	Thickness of dished end	3 mm	3 mm	3 mm
7.9	Motorised Stirrer	-----Propeller type with slow speed reduction gear unit-----		
7.10	Dissolving basket	NA	NA	Provided(50Mesh BS)
7.11	MOC -Dissolving basket	NA	NA	SS 316
7.12	MOC of stirrer(Shaft & propeller)	SS 304	SS 304	SS 316
7.13	Service factor for gear box of agitator	As per Manufacturer std.	As per Manufacturer std.	As per Manufacturer std.
7.14	Reduction ratio of gear box	As per Manufacturer std. (From 1500 rpm to 100-200 rpm)	As per Manufacturer std. (From 1500 rpm to 100-200 rpm)	As per Manufacturer std. (From 1500 rpm to 100-200 rpm)
7.15	Tip speed of Impeller of motorised stirrer (in RPM)	100-200	100-200	100-200
7.16	Access ladder & platform	To be provided	To be provided	To be provided
8.0	DOSING PUMP:			



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

8.1	Medium to be handled	Hydrazine solution	Ammonia solution	NaOH solution
8.2	Location	Indoor	Indoor	Indoor
8.3	Type of pump	-----Positive displacement plunger type Reciprocating pump -----		
8.4	Make of pump	----- As per approved sub vendor list-----		
8.5	Nos. of pump-motor assembly	Two (2×100%)	Two (2×100%)	Two (2×100%)
8.6	Capacity	0-50 LPH	0-50 LPH	0-10 LPH
8.7	Stroke per minute (SPM)	100	100	100
8.8	Design Temperature	50°C	50°C	50°C
8.9	Discharge pressure	45 Kg/Cm ² (g)	45 Kg/Cm ² (g)	10 Kg/cm2 (g)
8.10	Housing	Cast iron	Cast iron	Cast iron
8.11	Plunger	SS-304	SS-304	SS-316
8.12	All Wetted parts of pumps (Pump internals in contact with chemicals)	SS-304	SS-304	SS-316
8.13	Worm Shaft	EN8	EN8	EN8
8.14	Connecting Rod	EN8	EN8	EN8
8.15	Fasteners	SS-304	SS-304	SS-304
8.16	Anchor bolts (if applicable)	SS-304	SS-304	SS-304
8.17	Pump Mfg. standard /code	API 675	API 675	API 675
8.18	Pump Testing standard/code	API 675	API 675	API 675
8.19	Type of stroke control	Local manual & automatic	Local manual & automatic	Local manual & automatic
8.20	Stroke adjustment/Capacity control	0-100%	0-100%	0-100%
8.21	Noise level	<85 dB at a distance of 1 m	<85 dB at a distance of 1 m	<85 dB at a distance of 1 m
8.22	Connection at suction, Position	1" ANSI B16.5 #150, bottom	1" ANSI B16.5 #150, bottom	1" ANSI B16.5 #150, bottom
8.23	Connection at discharge, Position	1" ANSI B16.5 #300, top	1" ANSI B16.5 #300, top	1" ANSI B16.5 #150, bottom
8.24	Pulsation Dampener	-----One per each pump discharge-----		
9.0	STRAINERS:			
9.1	No. of strainers	Two (2×100%)	Two (2×100%)	Two (2×100%)
9.2	Type	Y-Type	Y-Type	Y-Type
9.3	Material of body	Stainless Steel	Stainless Steel	Stainless Steel
9.4	Material of screen	SS-304	SS-304	SS-304
9.5	Mesh Size	50 (BS)	50 (BS)	50 (BS)
10.0	Main, Drain, Main Drain Header, Sampling, Vent & Overflow Piping:			
10.1	Material	ASTM A 312 GR TP 304 SCH 40 (seamless)	ASTM A 312 GR TP 304 SCH 40 (seamless)	ASTM A 312 GR TP 304 SCH 40 (seamless)
10.2	Line size	As per P&ID (40NB/25 NB)	As per P&ID (40NB/25 NB)	As per P&ID (40NB/25 NB)
11.0	Valves:			
11.1	Gate & Globe valves	The following parameters are applicable for all three systems.		
11.1.01	Body, Bonnet, Stem	ASTM A182 Gr. TP 304.		
11.1.02	Design standard	ANSI B 16.34/API 602 for gate valves, BS 5352 for globe valve		



TITLE:
1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG
TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-423-154A-A001
 SECTION I
 SUB SECTION - IA
 REV.NO. 0 DATE :

11.1.03	Test standard	API 598		
11.1.04	Size	As per P&ID		
11.1.05	End Connections	SW / ANSI B 16.11		
11.1.06	Rating	-----Class ASA 800-----		
11.1.07	Valve operation	Manual		
11.1.08	Nuts & bolts (Fasteners)	SS-304		
11.2	Check valves/ NRV			
11.2.01	Body, cover, disc/piston	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304
11.2.02	Design standard	ANSI B 16.34/API 602	ANSI B 16.34/API 602	ANSI B 16.34/API 602
11.2.03	Test standard	API 598/MSS-SP-61	API 598/ MSS-SP-61	API 598/ MSS-SP-61
11.2.04	End Connections	SW/ ANSI B 16.11	SW/ ANSI B 16.11	SW/ANSI B 16.11
11.2.05	Rating	-----Class ASA 800-----		
11.2.06	Valve operation	Manual	Manual	Manual
11.2.07	Nuts & bolts (Fasteners)	SS-304	SS-304	SS-304
11.3	Pressure relief valve (PRV)			
11.3.01	Body, bonnet, disc, nozzle	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304
11.3.02	Valve discharges to	Mixing/storage Tank	Mixing/storage Tank	Alkali preparation/ dosing Tank
11.3.03	Back pressure	Constant	Constant	Constant
11.3.04	Set pressure	50 Kg/Cm ²	50 Kg/Cm ²	11 Kg/Cm ²
11.3.05	Nuts & bolts (if applicable)	SS-304	SS-304	SS-304
12.0	Fittings	Forged steel to A182 F304, Dimension to ANSI B 16.11 socket weld ends.		
13.0	Flanges (pump suction / pump discharge)	-----ANSI B 16.5 CL 150 / ANSI B 16.5 CL 300 -----		
14.0	Structural steel	IS 2062	IS 2062	IS 2062
15.0	Transfer/Hand pump			
15.1	Quantity	One (1)	One (1)	NA
15.2	Medium to be handled	Hydrazine	Ammonia	NA
15.3	Operation	Electrically operated	Electrically operated	NA
15.4	Location	Indoor	Indoor	NA
15.5	Flow	Up to 20 LPM (per 100 revolutions/ stroke)	Up to 20 LPM (per 100 revolutions/ stroke)	NA
15.6	Suction Head	Up to 2.5 MWC	Up to 2.5 MWC	NA
15.7	Delivery head	Up to 5 MWC	Up to 5 MWC	NA
15.8	Design Temperature	Up to 100°C	Up to 100°C	NA
15.9	Hand Pump Body	Cast Iron	Cast Iron	NA
15.10	Material (Pump internals in contact with chemicals)	SS-304	SS-304	NA
15.11	Capacity	-----To suit the requirement-----		NA
15.12	Numbers required	1x100%	1x100%	NA
15.13	Concentration	30%	35%	NA
15.14	Type of Pump	-----Electrical operated Barrel pump-----		NA

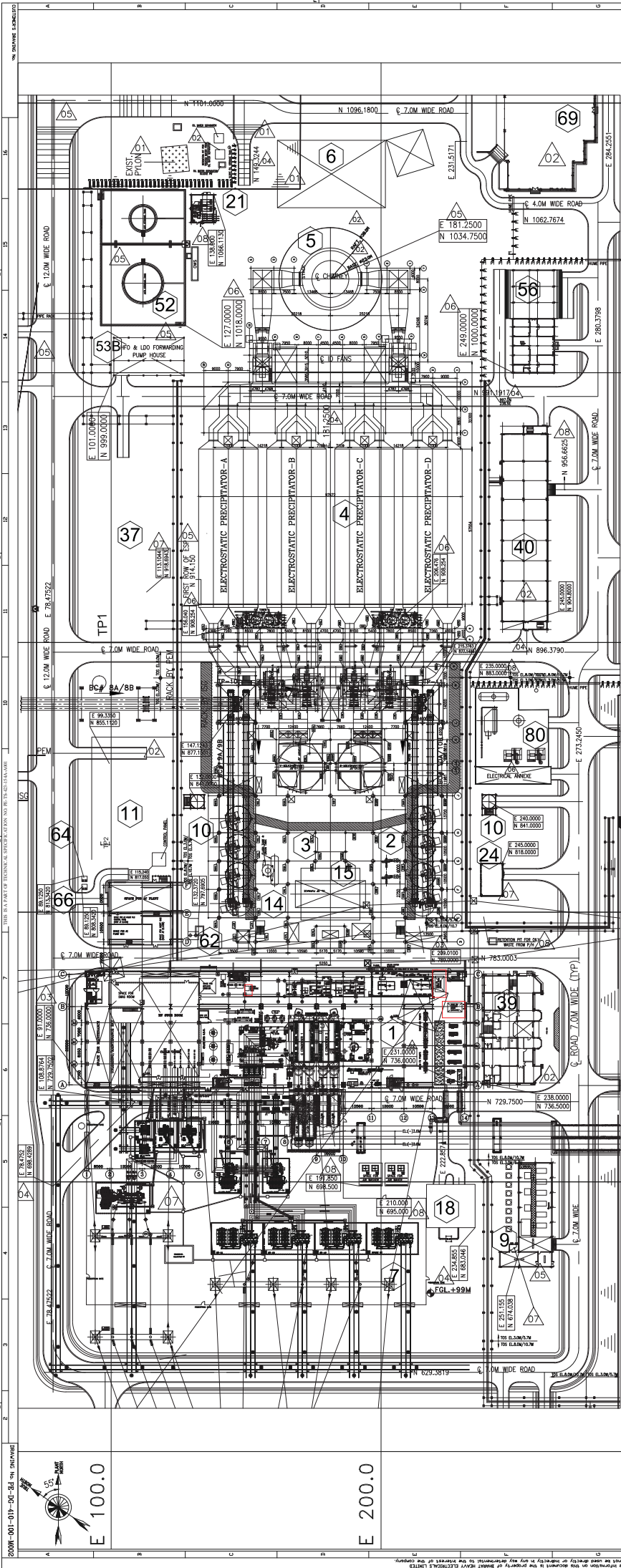


TITLE:
**1X800 MW COAL BASED NORTH CHENNAI TPP
STAGE –III-BTG**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-423-154A-A001
SECTION I
SUB SECTION - IA
REV.NO. 0 DATE :

16.0	Step ladder with platform	IS 2062	IS 2062	IS 2062
17.0	Nut & Bolt	SS-304	SS-304	SS-304



N 1100.0

N 1000.0

N 900.0

N 800.0

N 700.0

N 600.0

LEGEND :-

ROAD	PIPE/CABLE RACK
CONCRETE	RED BELT
GRAVEL	RED BELT
GRAVEL	RED BELT

NOTES :-

1. ALL DIMENSIONS AND CO-ORDINATES ARE IN METERS UNLESS NOTED OTHERWISE.

2. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

3. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

4. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

5. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

6. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

7. THE PLANT AREA IS 1000 M² (10000 SQ. M) AND THE BUILDING AREA IS 1000 M² (10000 SQ. M).

REFERENCE DWG. :-

1. SITE PLAN (GENERAL)

2. SITE PLAN (DETAILED)

3. SITE PLAN (DETAILED)

4. SITE PLAN (DETAILED)

5. SITE PLAN (DETAILED)

6. SITE PLAN (DETAILED)

7. SITE PLAN (DETAILED)

8. SITE PLAN (DETAILED)

9. SITE PLAN (DETAILED)

10. SITE PLAN (DETAILED)

11. SITE PLAN (DETAILED)

NUMBER	DESCRIPTION
69	ADMINISTRATIVE BUILDING
65	BOILER BLOW DOWN TANK
53B	HFO & LDO FORWARDING PUMP HOUSE
66	T.G. WASH WATER TANK
68	TRANSFORMER VARIOUS
7	SPACE FOR FGD PLANT
10	WATER STORAGE TANK DIVE AREA
14	WATER STORAGE TANK DIVE AREA
18	WATER STORAGE TANK DIVE AREA
24	BOOSTER PUMP HOUSE
40	ESP CONTROL ROOMS
56	PRE STATION

NUMBER	DESCRIPTION
1	POWER HOUSE BUILDING INCLUDING ELECTRICAL BAY
2	COAL MILL
3	STEAM GENERATOR
4	ESP
5	CHIMNEY
6	SPACE FOR FGD PLANT
18	WATER STORAGE TANK DIVE AREA
24	BOOSTER PUMP HOUSE
40	ESP CONTROL ROOMS
56	PRE STATION

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
1800 MT KOTAGUDAM TFS STAGE-VII UNIT#12, PALNCHIA
CONSULTING ENGINEERS
DEVELOPMENT CONSULTANTS PVT. LTD.

PROJECT: TELANGANA STATE POWER GENERATION CORPORATION LTD
1800 MT KOTAGUDAM TFS STAGE-VII UNIT#12, PALNCHIA
CONSULTING ENGINEERS
DEVELOPMENT CONSULTANTS PVT. LTD.

PROJECT: TELANGANA STATE POWER GENERATION CORPORATION LTD
1800 MT KOTAGUDAM TFS STAGE-VII UNIT#12, PALNCHIA
CONSULTING ENGINEERS
DEVELOPMENT CONSULTANTS PVT. LTD.

MAIN EQUIPMENT PLAN LAYOUT

DATE	10/01/2020
BY	10/01/2020
CHECKED	10/01/2020
APPROVED	10/01/2020

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB-SECTION - I B
		REV.NO. 0 DATE :

SUB-SECTION – IB
SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
		SUB-SECTION - I B
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

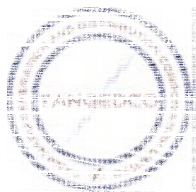
4.0 List of enclosures:

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Technical specification for LT switchgear
- g) Technical specification for motors

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION I
	STAGE -III-BTG	SUB-SECTION - I B
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

- h) Technical specification LV cables
- i) Technical specification cabling
- j) Technical specification for earthing & lighting protection

Motors



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.12 MOTORS

2.2.12.1 Design Criteria

- i. For the purpose of design of equipments /systems, an ambient temperature of 50 °C and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment.
- ii. Transient voltage dip on starting of the largest motor with DOL shall be limited to 20% of the nominal system voltage at the voltage terminals.

1. Rating

- i. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.
- ii. All motors shall be continuously rated (S1 duty). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.
- iii. Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

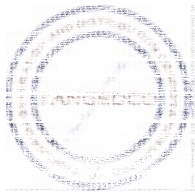
2. Starting Voltage requirement for all motors (except mill motors):

- i. 85 % of rated voltage for motors up to 1000 kW
- ii. 80 % of rated voltage for above 1000 kW and up to 4000 kW
- iii. 75 % of rated voltage for above 4000 kW

For Mill Motors:

- iv. 85 % of rated voltage for motors above 1000 kW
- v. 90 % of rated voltage for motors up to 1000 kW

3. Canopy shall be provided for outdoor motors.
4. Contractor shall provide fully compatible electrical system, equipments, accessories and services.
5. All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

6. Voltage and frequency variations:

- i. Frequency : (+) 3% and (-) 5%
- ii. Voltage :
 - A) AC:
 - a. $\pm 10\%$ for 11 kV/6.6 kV
 - b. $\pm 10\%$ for 415 V
 - B) DC: +10% to -15% for 220 V DC

- iii. Combined 10 % (absolute sum)

7. All LV motors above 10 kW with S1 duty.

- 8. Continuous duty LT motors rated above 0.37kW upto 200 KW Output rating (at 50 deg. C ambient temperature), shall be Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. However this is not applicable for geared motors (motors completely integrated with driven equipment) which are specifically designed to suit the driven equipment duty.**

The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

9. Type

- i. AC Motors:
 - a. Squirrel cage induction motor suitable for direct-on-line starting.
 - b. Crane duty motors shall be slip ring type induction motor
- ii. DC Motors
 - a. Shunt wound

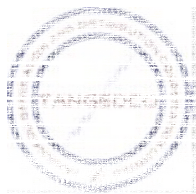
10. Temperature Rise

- i. **Air cooled** motors - 70°C by resistance method.
- ii. Water cooled - 80° C over inlet cooling water temperature mentioned elsewhere, by resistance Method.

11. Degree of Protection

Degree of protection for various enclosures shall be as follows:

- | | | |
|-------------------|---|-------|
| 1. Indoor motors | - | IP 54 |
| 2. Outdoor motors | - | IP 55 |



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

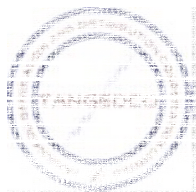
- | | | |
|---|---|-------|
| 3. CW motors (in case of screen prot. Drip proof) | - | IP 23 |
| 4. Cable box – indoor area | - | IP 54 |
| 5. Cable box – outdoor area | - | IP 55 |

2.2.12.2 Codes and Standards

1. All motors shall confirm to the latest editions including all applicable amendment of relevant IS, IEC and CBIP standards/Publications. In case any other standard is followed that ensures equal or better quality, may be accepted. However the English version of the Standard adopted shall be submitted.
2. Major Standards, which shall be followed, are listed below. Any other applicable Indian standards for any component part even if not covered in the list shall also be followed.
 - i. Three phase induction motors : IS:325, IEC:60034
 - ii. Single phase AC motors : IS:996, IEC:60034
 - iii. Crane duty motors : IS:3177, IEC:60034
 - iv. DC motors/generators : IS:4722
 - v. Degree of protection by enclosures for rotating electrical machines : IS: 4691 , IS: 4728, IS: 6362, IS: 2253
 - vi. Noise levels for rotating electrical machines : IS: 12065
 - vii. Mechanical Vibrations for rotating electrical machines : IS 12075

2.2.12.3 Operational Requirements

1. Starting Time
 - i. For motors with starting time less than 20 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs more than starting time.
 - ii. For motors with starting time more than 20 secs and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs more than starting time.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. For motors with starting time more than 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- iv. Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- v. Motors shall be capable of restarting under full load after a momentary loss of voltage with the possibility of 150 % nominal voltage during fast bus transfer.

2. Torque Requirements

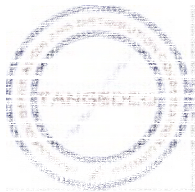
- i. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- ii. Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

2.2.12.4 Design and constructional features

1. Suitable single phase space heaters shall be provided on motors rated 30 kW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.
2. All motors shall be suitable for direct on line starting through any type of breaker.
3. All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below:
 - a. Fuel oil area : Group - IIB
 - b. Hydrogen generation plant area : Group - IIC

4. Winding and Insulation

Type	Non-hygroscopic, oil resistant, flame resistant
Starting Duty	Two hot starts in succession, with motor initially at normal running temperature.
11 kV / 6.6 kV AC motors	Class F: with winding temperature rise limited to class B. They shall withstand 1.2/50 micro sec switching surges of 4U+5 KV (U=Line voltage in KV).



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



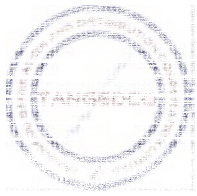
EPC TENDER SPECIFICATION FOR BTG PACKAGE

415V AC & 220V DC

The coil inter-turn insulation shall be suitable for 0.3/3 micro sec. surge of 32 KVp and 12 kVp for 11 kV and 6.6 kV system respectively followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation

Class 'F' with temperature rise limited to class 'B'

5. Motors rated above 1000 kW shall have insulated bearings to prevent flow of shaft currents.
6. Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7. Noise level and vibration shall be limited within the limits prescribed in IS: 12065 & IS: 12075 respectively. Motors shall withstand vibrations produced by driven equipment.
8. In MV/HV motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0°C, embedded in the stator winding at locations where highest temperatures may be expected, shall be provided. The material of the RTD's shall be platinum. Each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. All HV motors shall be provided with shaft grounding rings for bearing protection and earthing shaft current.
9. MV/HV motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage and shall be capable of either two starts in quick succession with third start after 5 minutes in cold condition or two starts at 15 minutes intervals in hot condition, both cases with voltage and frequency variation within specified limits.
10. Locked rotor current of the MV motors shall be limited to 600% (subject to IS tolerance) of the full load current of the motors and for HV motors (like BFP) shall be limited to 450% (inclusive of IS tolerance) of full load current of the motor. Locked rotor current of the LV motor shall not exceed 600% of full load current inclusive of IS tolerance.
11. MV Motors shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. These differential protection CTs for motors on 11/ 6.6 kV switchgear shall be supplied as loose.

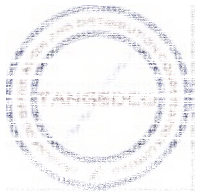


**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

12. Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
13. HV motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
14. All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
15. Motors rated 18.5kW and below shall be contactor controlled having MPCB incomers with intelligent controllers. Motors rated 18.5kW and above but below 90 kW shall be contactor controlled having MCCB incomers with intelligent controllers. Motors rated 90 kW and & above up to 200KW shall be ACB controlled with numerical relays. HV & MV Motors rated above 200 KW shall have vacuum breakers. HV motors rated 1000kW and above shall be provided with insulation bearings for avoiding bearing currents. HV Motors rated 1000KW and above shall also have differential protection. Care shall be taken by BTG Bidder to ensure that parameters of the differential CT being supplied along with motors (rated above 1000kW) match with the parameters of the differential CT being supplied by BTG bidder in 11kV Switchgear.
16. The motors shall be suitable for bus transfer schemes provided on the 11 kV, 6.6 Kv and 415V systems without any injurious effect on its life.
17. For motors rated 1000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
18. All motors shall be provided with an emergency stop push button near the motor as per the Indian Statutory regulations.
19. The motor terminal box shall be suitable for withstanding the maximum system fault current for a duration of at least 0.25 seconds.
20. Neutral in case of HV motors shall be kept accessible.
21. Motors shall be designed to easy access for drilling holes through motor feed of mounting flange for installation of dowel pins after assembly of the motor and driven equipment.



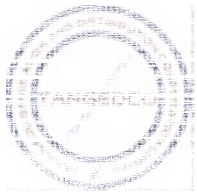
**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

22. Well spacious working platforms shall be provided around the motor area for carrying out maintenance & testing works. Platform shall be minimum of 300 mm below the level of motor base plate.
23. Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
24. For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box.
25. Lube oil pressure transmitters shall be provided to DCS for remote monitoring. Lube oil pressure very low trip to HV equipment shall be 2 out of 3 logic.
26. Capillary type temperature gauge cum switch shall be provided for DE / NDE of HV Motors.
27. Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
 - a) Hot and cold air temperatures of the closed air circuit for CACA motors.
 - b) Hot and cold, air and water temperatures for CACW motors.
28. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
29. **DIRECTION OF ROTATION**
As needed by driven equipment. The 3 phase motor shall, however, be suitable for operation in both directions of rotation. A plate showing direction of rotation as determined by the phase sequence on the terminals marking shall be screwed at non-driving end of the body of the motor. If, in the case of HV & MV motors, fan is suitable for only one direction of rotation, the fan shall be so designed that with the slight modification work, it can be made suitable for other direction of rotation also. No extra material shall be required for doing above modification work.
30. **BEARINGS**
Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 40000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing.
Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.

If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Unless otherwise approved, bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.

For MV & HV motors rated 1000KW and above, the bearings shall be insulated wherever necessary to prevent damage to motor bearings from shaft current.

When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing.

Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize setting. The selected lubricants shall be indigenously available.

Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings.

Bearings shall be of reputed make subject to the approval of the Purchaser/Consulting Engineer.

Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account.

31. TERMINAL BOXES

General

- i) Motors shall be provided with separate terminal boxes for main, space heaters, embedded temperature detectors, bearing temperature indicators and moisture detectors terminals, Neutral CT terminals. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. Terminal boxes shall be weatherproof and water-tight confirming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound. Space between and



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

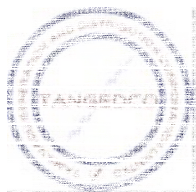
around terminals shall be adequate for easily connecting aluminium conductor cables. Terminal box arrangement shall be to the approval of the Purchaser /Consulting Engineer. All terminal boxes shall be suitable for proper termination cable to be finalized during detailed engineering.

- ii) The terminal boxes shall be complete with cable glands and termination accessories as required. Suitable non-magnetic material construction shall be adopted for terminal boxes where single core cables are to be terminated. All HV & MV motors shall be provided with phase segregated terminal box.
- iii) Terminal bushings and clamps shall be non-absorbent, non- inflammable, insulated material for connecting with cable.

Main Terminal Box

- i) LV Motors Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.
- ii) MV & HV Motors shall be provided with two (2) terminal boxes for stator terminals. One (1) terminal box shall be for phase terminals while other one for forming star connection. For motors rated below 1000 KW should be interchangeable to facilitate cable routing.
- iii) Neutral terminal box for HV motors rated 1000 KW and above shall be suitable for mounting of three (3) Nos. wound/bar primary/ring type cast resin insulated current transformers for differential protection. These CTs shall be mounted in the motor neutral terminal box. Stator phase terminal box shall be phase segregated terminal box suitable for both top or bottom entry of cables (i.e. they should be capable of being turned through 180 Degrees). The terminal box shall be designed for termination of XLPE cables using heat shrinkable terminating Kit. Terminal leading shall be stud type or leading wire type.
- iv) Terminal Boxes shall be provided with cable end boxes having cable lugs and cable glands for cables.
- v) The terminal boxes shall be capable of withstanding at the terminals the system fault level (as indicated below) without rupture for a duration of atleast 0.25 seconds.

a)	Min. fault level for 11kV Motors	- 50kA
b)	Min. fault level for 6.6 kV Motors	- 40kA
c)	Min. fault level for 415V Motors	-50kA



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- d) Min. fault level for 220V DC Motors -25kA
- vi) Phase to Phase/ Phase to Earth Air Clearance:-
 - a) Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:-

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

- vii) Terminal Accessories.....Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes.

32. TYPE AND SIZE OF CABLES

Space Heaters

- i) For LV Motors: Two point five (2.5) mm², two (2) core copper conductor PVC insulated, armoured and FRLS PVC sheathed heavy duty 650/1100 V grade cable to IS: 1554 (Part-I).
- ii) For MV & HV Motors: Six (6) mm² two core aluminium conductor XLPE insulated armoured and FRLS PVC sheathed heavy duty 650/1100V grade cable to IS: 1554 (Part-I).
- iii) For Embedded Temperature Detectors two sets of six (6) Twisted triad 0.5 mm² ATC copper conductor armoured, shielded cable, 650/1100 V Grade IS: 1554 (Part-I). For bearing temperature, RTDS, two (2) sets of four (4) twisted triad 0.5 mm², ATC copper conductor armoured shielded 650/1100 V Grade, IS: 1554 (Part-I).
- iv) Bearing Temperature Indicators - For each indicator, 0.5 mm² six (6) tarnished triad ATC copper conductor, PVC insulated, shielded armoured and FRLS PVC



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

sheathed heavy duty 650/1100 V grade cable as per IS: 1554 Part-I. Two (2) cables one (1) for each bearing temperature indicator.

v) For Moisture Detectors.....As for space heaters

For Main Terminals:-

i) LT Motors

a) Three (3) core cablesStranded aluminium conductor, XLPE insulated, colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire / strip armoured, FRLS PVC type-ST2 jacketed overall, 650 / 1100V grade, heavy-duty cables as per IS: 1554 (Part-I).

b) Single core cablesStranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured FRLS PVC type ST2 jacketed overall, 1100V grade, heavy duty cable as per IS: 1554 (Part-I).

ii) HV & MV Motors

Three (3) core cables stranded aluminium conductor, XLPE insulated, screened colour coded, laid up, FRLS PVC type ST2 sheathed, GI wire/strip armoured FRLS PVC type ST2 jacketed overall, 6.6 KV / 11 KV un earthed grade, heavy duty cables as per requirement for unearthed system as per IS: 7098 (Part-II).

33. GROUNDING

General..... Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor, size of grounding conductor shall be decided during detailed engineering.

LV Motors.....At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided.

HV & MV Motors.....Non-corrodible metallic grounding pad shall be welded or brazed at each earthing point. The size of grounding pad shall be 75x65x25 mm. Grounding pad shall have 40 mm apart two (2) drilled and tapped holes with hexagonal head bolts, plain washers and spring washers for size of conductor



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

specified. In addition, one suitable earthing terminal shall be provided inside the stator phase terminal box for earthing metallic shield of XLPE cables.

34. EMBEDDED TEMPERATURE DETECTORS

HV & MV motor shall be provided with four (4) Nos. simplex or two (2) Nos. duplex platinum resistance temperature detectors (RTDs) in each phase embedded in stator winding at locations where high temperatures are expected. In addition one (1) duplex type RTD shall be provided in each bearing. The RTDs shall be 3 wire duplex platinum resistance type having a value of 100 ohms at 0 Deg.C

35. BEARINGS TEMPERATURE INDICATORS

HV & MV motors shall be provided with dial type two (2) bearing temperature indicators and shall have two (2) sets of contacts, each set having 2 NO + 2 NC contacts rated for 5A at 240V AC and 0.5A at 220V DC. One set shall be set to operate at lower value to give alarm and other set at a higher value to trip the motor.

36. SPACE HEATERS

Valve / Damper actuator motors; and Motors 30 KW and above shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple.

The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box.

The space heater shall be wired to maintain the motor internal temperature above dew point when the motor is in idle condition.

37. HOT AIR TEMPERATURE DETECTOR

If the motor is of CACA or CACW enclosure, dial type temperature indicator shall be provided (one each for hot and cold air temperature monitoring for CACA and CACW and one each for inlet and outlet water temperature monitoring for CACW). If alarm and trip are required for cooling air temperature, temperature switch shall be provided.

38. WATER FLOW INDICATOR



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

If the motor is of CACW enclosure a provision shall be made for visual indication of water flow and flow switch shall also be provided with alarm contacts. Thermometers shall be provided in water inlet and outlet circuits.

39. MOISTURE DETECTORS

Motors with type of cooling 1C 81W or 1C 91 W shall be provided with moisture detectors for raising alarm in the event of water tube failure.

40. BED PLATE

Whenever motor is supplied with driven equipment the Supplier shall ensure that bed plate suits both motor and driven equipment and is adequately braced to keep vibration and misalignment within allowable limits to the approval of driven equipment and motor manufacturers.

41. Painting

Motor including fan shall be painted with corrosion proof paints of colour shade RAL 5012.

42. Local Push Button Stations

The LPBS shall be installed near the motors to be controlled. Individual channel supports shall be used for each LPBS. These shall be installed as per approved erection detail drawing. LPBS for hazardous areas shall be CMRS certified and CCE approved.

All LPBS shall have necessary canopies. Wiring of LPBS shall be checked before giving control supply.

Local push button station having only stop push button shall be provided for all the drive motors (HV, MV & LV motors).

The degree of protection of LPBs shall be IP65 with canopy.

All PBs shall be push to actuate type and the stop PB shall be lockable in off position as per the scheme requirement.

Emergency local stop push button should not be lockable. Stop Push buttons shall be mushroom type with latched or stay put feature with protective lid/cover. Start push button shall be self-reset type.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All push buttons shall be provided with 2 nos. NO and 2 nos. NC contacts for various interlocking purposes. One contact of stop PB shall be directly wired to the switchgear module for direct tripping and another contact to control system.

Terminals to be suitable for 2 cores of 2.5 sq.mm conductors with 20% spare terminals. All LPBs shall be of Di-cast aluminium/ FRP.

LPB shall be of following types:

1. Type-A: With Stop Push Button in FRP enclosure
2. Type-B: With Start & Stop Push Buttons in FRP enclosure
3. Type-C: With Forward, Reverse & Stop Push Buttons in FRP enclosure
4. Type-D: With Stop Push Button in flame-proof enclosure
5. Type-E: With Start & Stop Push Buttons in flame-proof enclosure
6. Type-F: With Forward, Reverse & Stop Push Buttons in flame-proof enclosure

43. OTHER ACCESSORIES

Motor shall be supplied with all accessories and parts other than those, specified above which are necessary and/or useful for efficient operation.

44. NOISE LEVEL

Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). at 1m from operating motor measured in accordance with IS: 10265.

2.2.12.5 Documents and Drawings

1. INFORMATION WITH PROPOSAL

AC Motor Data Sheet
Dimension Drawing/Foundation load details of motor and driven equipment.
Manufacturer's catalogue showing constructional details.

2. INFORMATION ON AWARD OF CONTRACT

Motor Data Sheet

Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Following characteristics curves:-

- i) Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment except for mill motor. For mill motor torque speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment
- ii) Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current speed curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage
- iii) Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor current time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- iv) Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor thermal withstand curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- v) Efficiency, power factor, current and speed versus power output curves.
- vi) Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage except for mill motor. For mill motor speed time curve for motor at ninety (90) hundred (100) and hundred ten (110) percent rated voltage.
- vii) Negative phase sequence current withstand characteristics.

2.2.12.6 List of tests to be conducted for HV, MV and LV Motors

1. Type tests

- i. No load saturation and loss curves up to approximately 115% of rated voltage.
- ii. Momentary overload test.
- iii. Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temperature shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iv. Surge withstand test on the sample coil after placing it in stator core at $(4U + 5 \text{ KV})$ and with at least five impulse of 1.2/50 micro sec. wave, for HV motors only, where U is the line to line voltage in kV.
- v. Surge-withstand test with 0.3/3 micro sec. wave on each type of 6.6/11 kV motor coils with at least five such impulses, followed by one minute power frequency high voltage test on turn to turn insulation, after cutting the coil and bringing out the turns suitably. The power frequency test voltage shall be decided during detailed engineering.
- vi. Dimensions (for motors covered by IS 1231:1974 and IS 2223:1983 only).
- vii. Measurement of resistance of windings of stator and wound rotor.
- viii. Reduced voltage running up test at no load (for squirrel cage motors up to 37kw only).
- ix. Full load test to determine efficiency, power factor and slip.
- x. Insulation resistance test.
- xi. Test for vibration severity of motor.
- xii. Test for noise levels of motor.
- xiii. Test for degree of protection by enclosure.
- xiv. Temperature rise test at limiting values of voltage and frequency variations.
- xv. Over speed test.

2. Routine Tests

The following shall constitute the routine tests.

- i. Insulation resistance test
- ii. Measurement of resistance of windings of stator and wound rotor.
- iii. No load test
- iv. Locked rotor readings of voltage, current and power input at a suitable reduced voltage
- v. Reduced voltage running up test (for squirrel cage motor)



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi. Open circuit voltage ratio of stator and rotor windings (for slip ring motors); rotor;
- vii. High voltage test

2.2.12.7 Inspection and Testing at site

1. Insulation resistance of 415V motors shall be measured between the winding of the machine and its frame by means of a 500/1000V megger. A minimum value of 1 mega ohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be brought up by any of the following methods as desired by the Site Engineer.
 - i. Blowing hot air in case of big motors.
 - ii. Putting the motor in electric oven in case of smaller motors.
 - iii. Placing heaters or lamps around and inside in case of small motors after making suitable guarding and covering arrangements so as to conserve the heat.
2. Site Test
 - i. Measurement of vibration.
 - ii. Measurement of insulation resistance and polarization index.
 - iii. Measurement of full load current.
 - iv. Test running of the motors, checking the temperature rise and identifying the hot spot etc.
3. 6.6 kV motors shall be tested for insulation by 500/1000V megger and its value should not be less than the safe minimum insulation of $\geq 20 \text{ M}\Omega$ resistance at 60 deg. C. In case the insulation is low, the following method of drying has to be adopted.
 - i. By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals that full load current flows in the stator, keeping the stator winding temperature below 90 deg. C. In this a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. Value becomes steady.
 - ii. By blasting hot air from external source, Maximum temperature of winding while drying should be 70 deg. C to 80 deg. C. (Thermometer) or 90 deg. C. to 95 deg. C. by resistance method. Heating should be done slowly till steady



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

temperature of winding is reached after 4 to 5 hours and for large machines after 10 hours. A record has to be kept for drying process, with half an hour readings and, after steady temperature is reached, at an interval of 2 hours. In case it is essential, the drying process can be supplemented by blower.

	TITLE LV MOTORS <u>DATA SHEET-A</u>		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 26.10.16
			SHEET	1 OF 1
1.0	Design ambient temperature	:	50 °C	
2.0	Maximum acceptable kW rating of LV motor	:	Upto 200KW	
3.0	Installation (Indoors/ Outdoors)	:	As required	
4.0	Degree of Protection	:	IP55	
5.0	Cooling	:	TEFC	
6.0	Details of supply system			
	a) Rated voltage (with variation)	:	415V $\pm$ 10%	
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)	
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)	
	d) System fault level at rated voltage	:	50 kA for 1 sec	
	e) Short time rating for terminal box	:	50 kA for 0.25 sec	
	f) LV System grounding	:	Solidly	
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B.	
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage	
9.0	Power cables data	:	Shall be given during Detailed engg.	
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.	
11.0	Space heater supply (30KW & ABOVE)	:	240 V, 1 Φ , 50 Hz	
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw	
13.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL	
14.0	Locked rotor current			
	a) Limit as percentage of FLC	:	As per IS 12615	
	b) Permissible tolerance, if any	:		
15.0	Additional tests	:	As per QP	
16.0	Flame-proof motor			
	a) Enclosure suitable (As per IS:2148)	:	As per requirement	
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement	
	c) Degree of protection	:	IP65	
17.0	Makes	:	AS PER ANNEXURE-I	
18.0	Terminal box	:	Suitable to rotate at 90 degrees	



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 26.10.16

SHEET 2 OF 1

19.0 Paint shade : **RAL 5012**
 20.0 Efficiency class : **IE3**

NOTE :

1. Also detailed Customer spec. for Motors is to be referred as enclosed with technical spec.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: CHEMICAL DOSING SYSTEM
SCOPE OF VENDOR: SUPPLY****PROJECT:1 X 800 MW NORTH CHENNAI TPP STAGE-III-BTG**

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

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: CHEMICAL DOSING SYSTEM
SCOPE OF VENDOR: SUPPLY**

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

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

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

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB-SECTION - I C
		REV.NO. 0 DATE :

SUB-SECTION – IC
SPECIFIC TECHNICAL REQUIREMENTS (CONTROL & INSTRUMENTATION)

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

1. Chemical Dosing system shall be operated from DCS (BHEL's scope).
2. All instruments shall be terminated at the Local Control Panel (LCP) in field. All the instruments as well as LCP are in bidder's scope.
3. For cable scope, refer to "Electrical Scope between BHEL and Vendor", elsewhere in the specification.
4. Any push buttons, alarms and metering requirement on the LCP panels shall be supplied by bidder and shall be finalized during detail engineering.
5. A local panel comprising of '**START**' push button, '**STOP**' push button & '**EMERGENCY STOP**' push button along with '**ON/OFF/TRIP**' indication, local/ remote indication, stroke position indicator, raise/ lower push button for stroke position and local annunciation shall be provided for local operation. The '**START**' and '**STOP**' push button shall be routed to **DDCMIS**. The '**EMERGENCY STOP**' push button (lockable type) shall be wired directly to **MCC**. The emergency push buttons EPB shall be lockable type. The detailed control philosophy has been mentioned elsewhere in the specification.
6. The LCP shall have 20% additional/spare terminals.
7. Level transmitter for level measurements in the tanks shall be DP type.
8. Painting of I&C equipment: Epoxy coating required for all I&C equipment.
9. Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.
10. Number of pairs to be selected for Screen /Control cable (Size : 0.5 mm²)
 - a. F-Type: 2P/4P/8P/12P/24P
 - b. G-Type: 4P/8P/12P
11. The make/model of various instruments/items/systems shall be subject to approval of BHEL/Customer during detailed engineering stage. No commercial and delivery implication in this regard shall be acceptable.
12. In case of any conflict and repetition of clauses in the specification, the more stringent requirements as per BHEL's interpretation shall be complied by the bidder.
13. The quantity of instruments indicated in the tender P & ID are indicative and to be treated as a minimum requirement for bidding purpose only. However, bidder shall also include in his proposal all the instruments and devices that are needed for completeness of the plant system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. Bidder to also include root valves along with necessary fittings for hooking up the above instruments. Double root valves shall be provided where pressure is exceeding 40 kg/cm². If any additional instruments, equipment are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
14. All the motorized valves shall be envisaged with integral starter.
15. Power supply requirement:

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

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION II
	STAGE –III-BTG	SUB-SECTION -
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

SECTION – II
GENERAL TECHNICAL REQUIREMENT
GENERAL TECHNICAL REQUIREMENT (MECHANICAL)-IIA
GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)-IIB
GENERAL TECHNICAL REQUIREMENT (C&I)-IIC

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION II
	STAGE –III-BTG	SUB-SECTION - IIA
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

SUB-SECTION – IIA

GENERAL TECHNICAL REQUIREMENT (MECHANICAL)



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

	guaranteed heat rate and computation of heat balance diagrams for guarantee conditions, shall be as tabulated under clause no. 2.1.3.51 (i) & (ii) above. Bidder shall be entitled of heat rate correction for variation in feed water pressure at economiser inlet (from the values tabulated above) as per correction curves to be submitted along with his offer.
(xi)	Pressure drop across reheat circuit specified above at point no – (ix) of 'Other conditions for computing heat balance diagrams' is inclusive of pressure drop across CRH NRV. For arriving at pressure drop across reheat circuit, pressure drop across CRH NRV has been considered 0.4% of HPT exhaust pressure. If the pressure drop across CRH NRV envisaged by the bidder is more than 0.4% of HPT exhaust pressure, then bidder shall increase the pressure drop to be considered in reheat circuit accordingly for HBD.

2.1.3.52 LP CHEMICAL DOSING SYSTEM

2.1.3.52.1 General

It is proposed to maintain chemistry of boiler feed water using Combined Water Treatment (CWT) using Oxygen Dosing in the feed water, generally as per the guidelines of EPRI, USA/VGB, Germany/CEGB, UK / relevant Japanese standard. The following parameters of feed water are proposed to be maintained:

Cation Conductivity	< 0.2 micro siemens / cm
Hydrazine	Nil
pH value (25 degree C)	8-8.5
Oxygen	20-200 ppb
Iron	< 10 ppb
Copper	< 2 ppb
Silica	< 10 ppb

- a. However, during startup or chemistry excursions, **All Volatile type of Treatment (AVT)** using ammonia and hydrazine dosing shall be used. The following parameters shall be maintained in case of AVT.

Cation Conductivity	< 0.25 micro siemens / cm
Hydrazine	10-15 ppb
pH value (25 degree C)	9.0-9.6
Oxygen	< 7 ppb
Iron	< 10 ppb
Copper	< 2 ppb
Silica	< 10 ppb

- b. Sodium and Chloride limit in case of both CWT & AVT feed water shall be maintained upto 2ppb each at Condensate Polishing Plant outlet. The proposed design features of the Condensate polishing plant



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

is indicated below and considering the above the Boiler Feed Water Treatment System shall be designed, supplied and installed by the Bidder.

c. The chemical regime given above is indicative only. Bidder shall furnish in his offer the appropriate chemical regime, which shall be discussed & finalised in case of award.

d. Design Features of Condensate Polishing (CPP) Plant:

(i) Three (3) service vessels (2W+1S), each of 50% capacity.

(ii) The design flow shall be the corresponding condensate flow

(iii) The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system

S.No.	Parameter	UOM	Normal Condition		Start-up or Condenser Leak	
			I/L	O/L	I/L	O/L
1	Crud	ppb	50	5	500	150
2	TDS	ppb	20	5	2000	---
3	Sodium	ppb	10	2	50	20
4	Iron(dissolved)	ppb	50	5	---	---
5	Ammonia	ppb	100	NIL	---	---
6	Silica(dissolved)	ppb	30	5	150	20
7	Chloride	ppb	10	2	---	---
8	Conductivity	Micro mhos/cm	---	<0.1 after cation column		

Under the above operating and design flow through the polisher units, the unammoniated resins shall not reach "ammonia break point" in less than 30 days (720 hrs) of continuous operation while maintaining the above effluent quality.

(iv) In addition to the dissolved solids, the influent condensate shall also contain some quantities of suspended solids (crud) derived from the corrosion of water and steam carrying pipelines, turbine condenser and steam side of the feed water heater. Normally this concentration will not exceed about 50 ppb and the polisher beds shall be provide sufficient filtering action to restrict the effluent crud content to less than 5 ppb.

(v) During start up conditions, quality of the influent may deteriorate to :-

Total dissolved solids, ppb : 2000 Max
 Silica, ppb : 150 Max
 Crud, ppb (mostly black oxide of Iron) : 1000 Max



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

For design purposes, average crud loading shall be considered as 500 ppb. Under such conditions, total crud content of the effluent shall not exceed 50 ppb.

- (vi) Under condenser tube-leakage condition, the plant shall be designed for 2000 ppb TDS in addition to the normal influent contaminants stated in as specified at (v) above. The cation and anion load in 2000 ppb TDS shall be based on the circulating water analysis. Under such condition, both sodium content and silica content of the effluent shall be limited to 20 ppb maximum.

2.1.3.52.2 Oxygen Dosing System

Complete Oxygen Dosing System shall be supplied and installed by the Bidder. It is proposed to dose Oxygen at two (minimum) locations in the Condensate and in Feed water circuit i.e. one at outlet of condensate polishing Plant and another at the outlet of deaerator (suction line to feed water pumps). Additional dosage points if required as per manufacturer's standard practice shall also be included by the Bidder.

Each of the dosing locations shall be provided with a set of Oxygen cylinders with required cylinder isolation/check valves, cylinder manifolds, isolation valves in the common manifold, piping from manifold, dosing (automatic type) valves of regulating valve, check (non-return type) valve, Instruments for measurement of oxygen & conductivity of condensate & feed water lines at the downstream of dosing locations, associated control system etc.

The dosing rate shall be regulated automatically by control system based on the quality of condensate water and feed water quality as the case may be. The control system shall facilitate selection of oxygen dosing locations. Regulating type valves shall be provided with isolation valves at upstream & downstream end to facilitate replacement/repair of regulating valve.

At each dosing locations, system shall be designed for a maximum dosage rate of 150 ppb and number of oxygen cylinders to supplied and installed by the Bidder shall cater for one month requirement. The condensate and feedwater flow shall be of the order of 1500 CU.M/hr and actual design flow shall be intimated to the successful Bidder later.

2.1.3.52.3 All Volatile Treatment (AVT)

- a. For AVT, Bidder shall include in his scope all necessary hardware including storage tanks, measuring tanks, mixing arrangement, However, generally all the tanks, oxygen cylinders, dosing facilities shall have redundancy of 100%. However minimum details for AVT are given below:



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No.	Description	Ammonia Measuring Tank	Ammonia Mixing / Storage Tank	Hydrazine Measuring Tank	Hydrazine Mixing / Storage Tank
i	Storage Capacity (in litres)	125	2300	30	2300
ii	Numbers	1 no./skid	1 no./skid	1 no./skid	1 no./skid
iii	Concentration of Aqueous ammonia solution shall be 29.4%				
iv	Concentration of Hydrazine Solution shall be 35%				

b. Tanks

Vertical and cylindrical design with dished/conical ends, SS-304 material of construction, shell thickness 3 mm for the tanks

c. Transfer pumps

Item Description	Ammonia Pump	Hydrazine Pump
Material (Pump internals in contact with Chemicals)	SS-304	SS-304
Capacity	To Suit Requirement	To Suit Requirement
Numbers Required	1X100%	1X100%
Concentration	30%	35%
Type of Pump	Electrical Operated barrel pump	Electrical Operated barrel pump

d. Metering pumps

Item Description	Ammonia Pump	Hydrazine Pump
Material (Pump internals in contact with Chemicals)	SS-304	SS-304
Capacity	0-50	0-50
Numbers Required	2 nos. (2X100%) per skid	2 nos. (2X100%) per skid
Rated Pressure	45 kg.cm2(g)	45 kg.cm2(g)
Type of Pump	Reciprocating Pump	Reciprocating Pump
Chemicals to be Handled		
Normal	30% Conc. Ammonia Soln.	0.6% Conc. Hydrazine Soln.
Wet Laying	15% Conc. Ammonia Soln.	35% Conc. Hydrazine Soln.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

e. MATERIAL FOR PIPING & FITTINGS

Item Description	Ammonia Pump	Hydrazine Pump
Piping	SS-304 /316	SS-304 /316
Fittings, valves & End Connection	A 182 GR.F304/316 A182 GR.F304/316 SW/ ANSI B16.11	A 182 GR.F304/316 A182 GR.F304/316 SW/ ANSI B16.11

Note:

Capacity of various tanks & pumps are tentative minimum. It is Bidder's responsibility to design/size these tanks & pumps depending upon system requirement/design and submit the same to Employer for approval. The minimum storage capacity for storage tanks of both Ammonia & Hydrazine shall be for 48 hours requirement.

- f. Unit shall be provided with a skid of hydrazine & ammonia dosing comprising of metering pumps (2x100%), strainer (2x100%), piping, valves, instrumentation etc. for both normal operation dosing as well as dosing required for wet laying of boiler. The capacity of tanks and parameters of pumps given are indicative & minimum. Final parameters shall be as per system requirements



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

d. Self-cleaning Filters

- 1) Two(2) (1w+1S) Body of filter shall conform to carbon steel to SS316L.
- 2) Strainer element shall be constructed to perforated stainless steel plate lined with SS 316 screen (SS 316L for sea water application)
- 3) The mesh size shall be selected on the basis of average clearance between the plates of the plate heat exchanger.

e. Overhead DM make-up tank

- 1) The overhead DM make-up tank shall be of MS construction with plates conforming to IS 2062/ ASTM A36 and minimum thickness of shell shall be 6mm. The internal surface of the tank shall be epoxy coated or rubber lined in three layers with total thickness not less than 4.5mm.
- 2) All accessories such as vents, overflow and drain, CO₂ absorber for vent, seal for overflow, manhole & staircase, level indicator, level transmitter and level switch etc. shall be provided.

f. Alkali preparation/ dosing system

One no. alkali preparation/ dosing tank of minimum 500 liter capacity shall be provided for gravity feed of alkali solution to overhead DM tank and suction piping of ECW system. The tank shall be of MSRL/ stainless steel construction with SS 316 basket, SS 316 agitators with great reducer unit and other accessories. Alternatively, dosing system may comprise of one no, alkali preparation/ dosing tank along with 2X100% dosing pumps in SS 316 construction for dosing of alkali solution at suction of DMCW pumps.

g. Piping

Design features of Piping and Valves of Equipment Cooling Water system shall be as per the Volume II, Section 2 Part 2.1.6.

2.1.4.3 Sizing Criteria

a. Pumps

- 1) Design flow of pump shall be taken as equipment/ process requirement plus 10% margin.
- 2) Design head shall be calculated as per system requirement with 10% margin considered in piping friction head.
- 3) The pump shall be capable of supplying process flow requirement at 47.5 Hz frequency of power supply.
- 4) Continuous rating of the motor at 50°C ambient temperature shall have minimum 10% margin over the maximum power requirement of the pump in its entire characteristic curve.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

LOW PRESSURE PIPING SYSTEM



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.1.6 LP PIPING, VALVES & SPECIALITIES

2.1.6.1 Equipment sizing Criteria

- a. All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.
- b. For all LP piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.
- c. Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following.

i. Water Application

Sl.No.	Pipe Size	Below 50mm	50-150 mm	200 mm & above
1	Pump suction	-	1.2-1.5	1.2-1.8
2	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
3	Header	-	1.5-2.4	2.1-2.4

The pipes in CW, ACW & DMCW system shall be designed to maintain a maximum velocity of 2 m/s inside the pipelines at pump discharge. 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.

- ii. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value.

1	Carbon steel pipe	100
2	CI Pipe/Ductile Iron	100
3	Rubber lined steel pipe	120
4	Stainless steel pipe	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/sump/reservoir from which the pumps draw water

- iii. Compressed Air Application
Compressed air – 15.0 m/sec. (under Average Pressure & Temp. conditions)



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- d. The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.
- e. Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.
- f. Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.
- g. Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.
- h. High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.
- i. Material of construction for pipes carrying various fluids shall be as specified elsewhere.
- j. Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.
- k. Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.
- l. Threaded joints shall be provided with Teflon sealant tapes.
- m. Following types of valves shall be used for the system/service indicated.

System	Type of Valves					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & Vents		x	x	x		
Fuel oil		x	x	x	x	x

In water service, valves above 200 NB size shall be butterfly valves.

- n. Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- o. All Piping 450 NB & Above shall be designated as Large dia Piping.

2.1.6.2 Technical Specification

2.1.6.2.1 General

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers/supports, tanks etc.

2.1.6.2.2 Pipes and fittings

- a. All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as adhered to. The bidder shall furnish the pipe sizing / thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.
- b. Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.
- c. Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the Bidder and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.
- d. Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).
- e. Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.
- f. The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/expansion joint etc. shall be provided as may be necessary depending on layout.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- g. Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.
- h. For rubber lined ERW pipes, beads shall be removed.
- i. Inspection holes shall be provided at suitable locations for pipes 800 NB and above as required for periodic observations and inspection purposes.
- j. At all intersection joints, it is Bidder's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.
- k. For large size pipes/duct, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code. Transient analysis / surge analysis wherever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems such as CW/ ACW/ Raw Water etc.

2.1.6.2.3 Material

- a. Alternate materials offered by Bidder against those specified shall either be equal to or superior to those specified, the responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.
- b. No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.
- c. All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockiest are not acceptable.
- d. All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable reference to enable identification of the certificate that certifies the material.
- e. Material of construction for pipes carrying various fluids shall be as follows:

1	Circulating Water (CW) – Pump Discharge, condenser risers including header near condenser and cooling tower rise	IS 3589 FABRICATED FROM IS 2062 PLATES –INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT /GRP/ FRP
---	--	---



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2	ACW	UPTO 150 NB - ASTM A 312 TP 316 L (ERW)/ DUPLEX SS 200 NB & ABOVE - ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- Internally lined with Corrocoat or polyureA Coating inside of 1500 microns DFT
3	RO Stage II Permeate, Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water) & DMCW overhead tank make-up water	Stainless steel to ASTM A-312, Gr. 304 welded for sizes above 50mm NB Stainless steel to ASTM A312, Gr. 304 sch. 40 Seamless for sizes 50 mm and below
4	Drinking water	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.
5	Instrument air & plant air.	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.
6	Fuel Oil piping	API5L
7	FUEL OIL PUMP DISCHARGE LINES	ASTM A 106 GR B
8	Sodium Hypochlorite (pipes & Fittings)	CPVC Sch 80 ASTM

- f. In water lines, pipes upto 150 mm NB shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B/IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS: 1239 Grade heavy except for dematerialized water and condensate spill lines.
- g. Pipes of above 150 mm NB shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr. 410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. B/ASTM-A-36. However, larger pipes, i.e. 1000 mm NB and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. B and shall meet the requirements of AWWA-M-11(for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/ surge conditions, truck- load, rail-load and weight density for compacted soil or any other load as the case may be).
- h. In dematerialized water service, the pipes up to 50 NB shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65 mm NB up to and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.
- i. Bidder shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- j. Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410/IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B/IS: 3589, Gr. 410/IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).
- k. Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.
- l. Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.
- m. If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.

2.1.6.2.4 Piping Wall Thickness

- a. The calculation of wall thickness required for pipelines subject to internal and/or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc., and the same shall be subject to approval by Purchaser. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.
- b. In case of carbon steel materials, the nominal wall thickness of pipeline shall not be less than the minimum acceptable values given below:

NB mm (inch)	15 (1/2)	30 (3/4)	25 (1)	32 (1¼)	40 (1.5)	50 (2)	65 (2.5)	80 (3)	100 (4)	125 (5)
Min. thickness, mm	3.2	3.2	3.6	3.6	3.6	3.6	3.6	4	4.5	5.4
NB mm (inch)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	600 (24)
Min. thickness, mm	5.4	6.35	6.35	6.35	7.1	7.1	7.1	8	8	8

> NB 600 mm to NB 900 mm	-	8.0 mm
> NB 900 mm to NB 1200 mm	-	10.0 mm
> NB 1200 mm to 1400 mm	-	12.0 mm
> NB 1400 mm to 1600 mm	-	14.0 mm
> NB 1600 mm to NB 2200 mm	-	16.0 mm



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

> NB 2200 mm - 18.0 mm

2.1.6.2.5 Piping Layout

- a. Piping shall be grouped together where practicable and routed to present a neat appearance.
- b. Piping 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 various equipment.
- c. Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8 m above roadways/railways. When several pipelines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be 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.
- d. Pipelines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipe and submit to Employer for approval.
- e. All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc.
- f. Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.
- g. Piping shall generally be routed above ground but where specifically indicated / approved by the project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.
- h. Sufficient upstream and downstream lengths shall be provided for flow measuring devices, control valves and other specialties.
- i. All local instruments shall be located on pipelines as to render them observable from the nearest available platforms.
- j. Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.

2.1.6.2.6 Slope/Drains and Vents



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- a. Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent shall not be less than 15 mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15 mm for line size up to 150 mm, not less than 20 mm up to 300 mm and not less than 25 mm for 350 mm to 600 mm pipes and not less than 50 mm for 600 mm and above pipes.
- b. Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.

2.1.6.2.7 Pipe Joints

In general all water lines 65 mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50 mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.

- a. Screwed
 - i. 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.
 - ii. Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portion at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.
 - iii. Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.

- iv. For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate pasts. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.
- v. For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

b. Welded

- i. For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

c. Flanged

- i. Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.
- ii. All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.
- iii. Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

2.1.6.2.8 Bends/elbows/mitre bends/Tees/Reducers & other fittings

- a. Unless otherwise specified elbows shall be of long radius type.
- b. For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.
- c. For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 250 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

shall be 1½ times the nominal pipe diameter. 90 deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

- d. Mitre bends are not acceptable in case of rubber lined mild steel pipes.
- e. For pipe fittings such as reducers and tees, the material shall be to ASTM-A-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fittings shall conform to the dimensional standard of ANSI B-16.9. However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239. For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.
- f. Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea Water application, if any) Class-S, for sizes up to and including 50 mm NB, i.e. the fitting shall be of seamless construction. However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.
- g. In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

2.1.6.2.9 Flanges

- a. Flanges shall be slip on type. Welding of flanges in tension is not permitted.
- b. All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc flanges & bolts & nuts shall be SS 316 L construction.

2.1.6.2.10 Specific technical requirement of laying buried pipe with anti corrosive treatment

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

- a. Trenching
 - i. The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.
 - ii. Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000 mm between the top of the pipe and finished grade.
 - iv. Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS: 5822 to provide an acceptable bed for placing the pipe.
 - v. Coating and Wrapping shall be done as under.
- b. Preparation and cleaning of piping
- i. The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.
 - ii. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.
 - iii. The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coating manually at site after laying, welding and testing the pipe.
- c. Trench bed preparation and back filling
- Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.
- d. Laying of galvanized steel (GI) pipes
- All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joints shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

2.1.6.2.11 Cleaning and Flushing

- a. All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.
- b. Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.

- c. After erection, all water lines shall be 1.2-1.5 times the operating velocities in the pipelines.
- d. All compressed air pipe work shall be cleaned by blowing compressed air.

2.1.6.2.12 Painting of Pipes

a. Buried Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns. Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- iii. Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982The total thickness of the coating will not be less than 4.0 mm
- iv. Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm. Tests to be carried out after application : Bond/ Adhesion test, Holiday test

b. Overground Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns.

External surfaces

- i. Surface cleaning by Sand Blasting.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.
- c. **Other requirements**
 - i. Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.
 - ii. The color of the finish paint shall be as per approved color-coding.
 - iii. If finish paint was applied in shop, one coat of finish paint shall be applied at site.
 - iv. The dry film thickness of paint shall not be less than 0.15 mm.
- d. **Colour code for identification**
The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

2.1.6.2.13 Specification for hangers and supports

- a. All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.
- b. While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining
- c. Hanger for piping 65 mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.
- d. Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS:226/ or equivalent. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. The structural steel work shall be as per IS: 800/BS:4360. Insulation protection saddles shall be used at support point of all insulated piping.
- e. The support 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.
- f. The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.
- g. All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.
- h. At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- i. All components of hangers/support shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.

2.1.6.2.14 Design/Construction/Material Particulars of Gate/Globe/Check Valves/Globe Stop Valve/Butterfly Valve

a. General

- i. All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- ii. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- iii. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
- iv. All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
- v. All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
- vi. All valves shall have indicators or direction clearly marked on the hand- wheel so that the valves opening/closing can be readily determined.
- vii. Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350 mm and above either bevel or spur gearing shall be provided to facilitate manual operation. (h) The valves coming in vacuum lines shall be of extended gland type and / or water sealed.
- viii. The actuator-operated valves shall be designed on the basis of the following:
 1. The internal parts shall be suitable to support the pressure caused by the actuators.
 2. The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 3. All actuator-operated valves shall be provided with hand operated gearing mechanism also.
 4. All actuators operated valves shall open/close fully within time required by the process.
- ix. Valves coming under the purview of IBR shall meet IBR requirements.
- x. Gate/sluice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:
 1. Hand wheel
 2. Position indicator (for above 50 mm NB valve size)
 3. Draining arrangement wherever required.
- xi. Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- xii. Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- check valves are preferable for its spring controlled opening/closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600 mm NB.
- xiii. All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.
 - xiv. All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.
 - xv. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
 - xvi. Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the Bidder wherever necessary in consultation with project manager within the bid price at no extra cost to employer.
 - xvii. All valves except those with rising stems shall be provided with continuous mechanical position indicator; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.
 - xviii. For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.
- b. Valve Body Material
- Valve body material for various services shall be as follows: Valve body material for water application like DM Cooling Water (Passivated DM Water) (DMCW), RO Stage I Permeate, AHP Seal Water, APH/ ESP Wash, Service Water, Potable Water, HVAC Make UP shall be cast iron for sizes 65 NB and above; gun-metal/ Forged Carbon Steel for sizes 50 Nb and below.
- Valve body material for sea water application like Circulating Water. Auxiliary Cooling water, Blowdown, CT make up, sea water Intake, Guard pond inlet & Discharge, Ash Water using sea water, RO Stage II reject, RO Stage I reject, Reject Sump discharge and all other sea water applications shall be SS 316 L for all sizes.
- For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. Condensate: Cast Carbon Steel/Forged Carbon Steel.
- i. The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

AWWA-C-504	Rubber seated butterfly valves
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valve
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves
ANSI B 16.34	Standard for valves
API-594	Standard for Dual-check valves
API-600	Steel gate valves
ANSI-B-16.10	Valves face to face and other relevant dimension
API-598	Valves inspection test

ii. End Connections

The end connections, shall comply with the following:

Socket welding (SW) – ANSI B 16.11

Butt Welding (BW) – ANSI B 16.25

Threaded (SC) – ANSI B 2.1

Flanged (FL) – ANSI B 16.5 & AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges)

- iii. All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).
- iv. All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.
- v. All gun metal body valves shall have screwed ends.
- vi. All flanged end valves/specialties shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints

2.1.6.2.15 Check Valves

- a. Check valves shall comply with the following characteristics:
 - i. For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);
 - ii. For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.
 - iii. In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.
- b. Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.
- c. All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.
- d. Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.1.6.2.16 Globe Valves

- a. The globe valves shall have the following characteristics; Straight conveyed flow Right angle Preferably, the valves shall be of the vertical stem type.
- b. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.
- c. The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided
 - i. No possibility exists that flow from above the disc can remove either the disc from stem or component from disc
 - ii. Manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.
- d. For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.
- e. All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.

2.1.6.2.17 Gate valves

All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.

2.1.6.2.18 Air Release Valve

- a. The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.
- b. The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.
- c. Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260 and spindle shall conform to high tensile brass.
- d. Air release valves shall not have any integral isolation devise within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/butterfly valve.

2.1.6.2.19 Butterfly Valves

- a. Design/Construction
 - (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN- 593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.
 - i. The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.
 - iii. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
 - iv. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
 - v. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.
 - vi. The operating mechanism shall be mounted directly on or supported from the valve body.
 - vii. All valves shall be complete with: Position indicator (located in a visible place) Arrow indicating the flow direction; Adjustable mechanical stop limiting devices to prevent over Travel of valve disc in open/close position. All valves shall be "tight shut off"
 - viii. Hand operated valves shall have the following Local hand controls the hand controls shall close the valve with clockwise rotation. The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions. The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation. Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300 mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure. Valves-350 Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same. Valves-350 Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.
- b. Material of Construction (Butterfly Valves)
- Materials and other design details shall be as indicated below:
- i. Cast Iron Butterfly valves

Body & Disc	ASTM A48, Gr. 40 with 2% Ni/IS: 210. Gr. FG-260, with 2% Ni and epoxy coated
-------------	---



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Shaft	BS 970 431 S: 291/EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
Seal	Nitrile Rubber
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

- ii. Duplex Stainless Steel Butterfly valves (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc.)

Body & Disc	SS 316 L
Shaft	SS 316 L.
Seat ring	SS 316 L
Seal	Nitrile Rubber
Companion Flanges	SS 316 L
External hardware	SS 316 L
Internal hardware	SS 316 L

- iii. Stainless Steel Butterfly Valves

Body & Disc	ASTM A 351, Gr. CF8M/ASTM-A-182-Gr. 304
Shaft	ASTM A 182, Gr. 316/ASTM-A-479 Gr. 316/Equivalent
Disc & Seat ring	EPT/BUNA-N/Neoprene
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

- iv. Carbon Steel Butterfly Valve

Body & Disc	ASTM A 216, Gr. WCB
Shaft	ASTM A 182, Gr. 304/ASTM-A-479 Gr. 304/Equivalent
Disc & Seat ring	EPT/BUNA-N/Neoprene



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

c. Proof of Design Test (Type Test) for Butterfly Valves

Proof of Design (POD) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual POD test shall be conducted by the bidder in the presence of Employer's representative. All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of POD test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the POD test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of POD test of AWWA-C-504.

2.1.6.2.20 MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)

a. The materials shall generally comply with the following:

i. Cast Steel Valves

Body & bonnet	ASTM A 216 Gr. WCB/ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316
Internal hardware	SS 316

ii. Stainless Steel Valves

Body & bonnet	ASTM A 351 Gr. CF 8M/ASTM A 182 Gr. 304
Disc	-
Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479 Gr. 316 or Integral with body
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

iii. Cast Iron Valves

Body & bonnet 260	BS 1452 Gr. 14/IS-210 Gr. FG
Seating surfaces and rings	13% chromium steel/13% Chrome overlay
Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Hinge pin for non-return valves	AISI 316
Stem for gate globe valves	13% chromium steel or Equivalent
Back Seat	13% chromium steel / 13% Chrome overlay
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

iv. Gun Metal Valves

v.

Body & bonnet	IS 318 Gr. 2/Equivalent Standard
Trim.	-
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

vi. Duplex Stainless Steel (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

Body & bonnet	SS 316 L
Disc for non-return	SS 316 L
Stem	SS 316 L
Trim.	SS 316 L
Companion Flanges	SS 316 L
External hardware	SS 316 L
Internal hardware	SS 316 L

- b. Cast iron body valves shall have high alloy steel stem and seat.
- c. Material for counter flanges shall be the same as for the piping except for sea water application.

2.1.6.2.21 Float Operated Valves

- a. Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.

b. Design and Construction Features

The following design and construction feature of the valve shall be the minimum acceptable.

- i. Valves shall be right-angled or globe pattern.
- ii. Valves shall be balance piston type with float ball.
- iii. Leather liner shall not be provided.
- iv. The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or Is: 210 Grade 200 or equivalent, and float shall be of copper with epoxy painting of two (2) coats. For all sea water applications the complete valve shall be SS 316 L construction.
- v. Valves shall be suitable for flow velocities of 2 to 2.5m/sec.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi. The valves shall have flanged connections.

2.1.6.2.22 Painting of valves

Two (2) coats of primer followed by three (3) coats of epoxy of approved colour code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the Bidder by repainting with compatible painting primer and enamel to the satisfaction of the project manager.

2.1.6.2.23 Rubber Expansion Joints

- a. All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.
- b. The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.
- c. The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.
- d. The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.
- e. Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.
- f. Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipelines.
- g. The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.
- h. The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.
- i. All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr. B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.
- j. The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.
- k. All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
- l. Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- m. Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
- n. Bidder to note that any metallic part which comes in contact with DM / Corrosive water shall be of stainless steel material.
- o. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc. the bolts & nuts, stretcher plates and companion flanges shall be SS 316 L.

2.1.6.2.24 STRAINERS

a. Simplex type

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition fitted with a removable plug. The material of construction of various parts shall be as follows:

1	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent) SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
2	Strainer Element	Stainless steel (AISI 316) SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
3	End connection	Screwed upto 50 mm Nb, and flanged above 50 mm Nb

b. Duplex type

- i. The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.
- ii. Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

1	Body	IS: 318, Gr. 2 Up to 50 mm Nb, and IS:210, Gr. FG 260 of ASTM-A-515 Gr. 75/IS-2062 Gr. B and internally epoxy-painted above 50 NB. SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc.)
---	------	---



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2	Strainer element	Stainless steel (AISI 316)/ SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
3	End connection	Screwed up to 50 mm NB, and Flanged above 50 NB. Gasket shall be of full face type

- iii. The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.
- iv. The size of the strainer and the flow direction will be indicated on the strainer body casting.
- v. Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.
- c. Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION -II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB-SECTION - IIB
		REV.NO. 0 DATE :

SUB-SECTION – IIB
GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)

	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 SPECIFICATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

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

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

	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 LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

LV Cables

**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE****2.2.16 LV CABLES****2.2.16.1 Codes and Standards**

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS : 3961	: Recommended current ratings for cables.
IS : 3975	: Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 4905	: Methods for random sampling.
IS : 5831	: PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	: Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100V.
IS : 8130	: Conductors for insulated electrical cables and flexible cords.
IS : 10418	: Specification for drums for electric cables.
IS : 10810	: Methods of tests for cables.
ASTM-D -2843	: Standard test method for density of smoke from the burning or decomposition of plastics.
ASTM-D-2863	: Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastics.
IEC-60754 (Part-I)	: Test on gases evolved during combustion of electric cables.
IEEE-383	: Standard for type test of Class IE Electric Cables.
IEC -60332	: Tests on Electric cables under fire conditions.
IS:6380	: Specification of elastomeric insulation and sheath of electric cables
IS:5608	: Specification for low frequency wires and cables with PVC insulation and PVC Sheath.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

IEC:502	: Extruded solid dielectric insulated power cables for rated voltages from 1.00 kV upto 30 kV
IEC:287	: Calculations of the continuous current rating of cables (100% load factor)
IEC:228	: Conductors for insulated cables
IEC: 60	: High voltage test techniques
IEC: 230	: Impulse tests on cables and their accessories
IEC-331	: Fire resisting characteristics of electric cables
NEMA-WC-5	: Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
IEC: 540	: Test methods for insulations and sheaths of electric cables and cords (elastomeric and thermoplastic compounds)
SS-4241475 classF3	: Cables - Testing of fire characteristics
NES-715-1	: Temperature index

2.2.16.2 Technical Requirements

1. The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.
2. Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.
3. Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.
4. XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250°C.
5. The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

6. For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables armouring shall be of galvanised steel as follows :

Calculated nominal dia Size and Type of armour of cable under armour

- i. Up to 13 mm 1.4mm dia GS wire
 - ii. Above 13 & upto 25mm 0.8 mm thick GS formed wire / 1.6 mm dia GS wire
 - iii. Above 25 & upto 40 mm 0.8mm thick GS formed wire / 2.0mm dia GS wire
 - iv. Above 40 & upto 55mm 1.4 mm thick GS formed wire /2.5mm dia GS wire
 - v. Above 55 & upto 70 mm 1.4mm thick GS formed wire / 3.15mm dia GS wire
 - vi. Above 70mm 1.4 mm thick GS formed wire / 4.0 mm dia GS wire
7. The aluminium used for armouring shall be of H4 grade as per IS:8130 with maximum resistivity of 0.028264 ohm mm² per meter at 20 deg C. Aluminium armouring shall be same as indicated above for galvanized steel.
8. The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.
9. Cable Identification
1. Outer sheath shall be of PVC (of suitable grade) & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
 - a. Oxygen index of min. 21 (As per NES-715-1).
 - b. Acid gas emission of max. 20% (As per IEC-60754-I).
 - c. Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM D-2843.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:
 - a. 1 core - Red, Black, Yellow or Blue
 - b. 2 core - Red & Black
 - c. 3 core - Red, Yellow & Blue
 - d. 4 core - Red, Yellow, Blue and Black
3. For reduced neutral conductors the core shall be black.
4. In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.
 - a. Cable size and voltage grade - To be embossed.
 - b. Word 'FRLS' at every 5 metre - To be embossed.
 - c. Sequential marking of length of the cable in metres at every one metre-To be embossed / printed.

The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
5. Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.
 - a. 1core - Red, Black, Yellow, Blue
 - b. 2 core - Red & Black
 - c. 3 core - Red, Yellow & Blue

10. All cables shall meet the fire resistance requirement of IEEE - 383 with cable installations made in accordance with clause "Flammability test" and as per Category-B of IEC 60332 Part -3.
11. Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum over the declared value in the technical data sheets.
12. In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc, are not acceptable.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.16.3 Cable selection & sizing

1. Cables shall be sized based on the following considerations:
 - i) Rated current of equipment.
 - ii) Maximum voltage drop limits under steady state and during starting for motor being fed from 415V switchgear restricted to 5% and 10% respectively.
 - iii) Maximum voltage drop limits under steady state for feeder (i.e. Outgoing feeders being fed from 415V switchgear) restricted to 3%.
 - iv) For cables to motors and feeders protected by MCCBs the cross section will be chosen according to the tripping time of MCCBs.
2. Derating Factors

Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:

 - a. Variation in ambient temperature for cables laid in air.
 - b. Grouping of cables.
 - c. Variation In ground temperature and soil resistivity for buried cables.
3. Cable lengths shall be considered in such ways that straight through cable joints are avoided.
4. Cables shall be armoured type if laid in switchyard area, coal handling area or directly buried. All LV power cables except trailing cables shall be XLPE insulated FRLS.
5. All control cables shall be 2.5 Sq mm copper cable.
6. Multicore control cables will generally have spare conductor (s) in accordance with the following chart and cores of a single cable will not be split for different auxiliary/ equipment:



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Conductors	Required Cables
1 or 2	: 1-3/C
3 or 4	: 1-5/C
5 or 6	: 1-7/C
7 or 8	: 1-10/C
9 or 10	: 1-12/C
11 or 12	: 1-16/C
13 or 14	: 1-18/C
Above 14 core	: Two or more of above cables

2.2.16.4 Constructional Features

i) 1.1 kV grade Power Cables

- 1.1 kV grade XLPE power cables shall have compacted aluminium conductor for cables including 10 sq. mm and above and copper conductor for cables below 10 sq.mm, XLPE insulated, PVC inner-sheathed (as applicable), armoured, FRLS PVC outer-sheathed conforming to IS: 7098. (Part-I).
- 1.1 kV grade Trailing cables shall have tinned copper (class 5) conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber (EPR) suitable for withstanding 90°C continuous conductor temperature and 250 deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.

ii) 1.1 kV Grade Copper Conductor Fire Survival Power Cables

- 1100 volt grade, 90 Deg.C rating, power cables with stranded Copper conductor, heat resistance elastomeric insulation generally conforming to Type IE-2 of IS: 6380-1984, extruded Halogen free or very low Halogen elastomeric inner sheath, generally conforming to Type SE-3 of IS-6380-1984, round wire/strip armour and extruded outer sheath of elastomeric material generally conforming to Type SE-3 of IS: 6380-1984.
- The cables shall be generally manufactured in conformity to IS-9968 Part-1/1988.
- The cables shall be rated for 3 hours fire rating.
- Conductor shall be of stranded construction, consisting of high conductivity annealed plain copper wires conforming to Class-II of IS 8130. A suitable heat barrier tape, preferably glass mica tape shall be provided over the Conductor.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

5. The insulation shall consist of heat resisting elastomeric material EPR (Ethylene Propylene rubber) and shall conform to Type IE-2 of IS:6380/1984 amended up to Date.
6. The suitable fire retardant material fillers shall be used for filling in the interstices. Two layers of plain glass fiber binder tape shall be applied over the laid up cores.
7. Fire Survival Power & Control cables shall be provided for the following services:
 - a. DC emergency lube oil pump.
 - b. Turbine lube oil pump/barring gear.
 - c. Jacking oil pump.
 - d. Scanner air fan.
 - e. Incoming & outgoing cables for DC lighting distribution board.
 - f. Fire /smoke detection system.
 - g. DC seal oil pump.
 - h. DC emergency lighting cables for Main Plant Building.
 - i. Incomer cables for DG board, emergency board, DC lighting board
 - j. Batteries to charger and DC distribution board.
 - k. Emergency turbine trip by push button in control room.
 - l. Boiler turbine: Generator inter-trip which includes the interconnecting cables between
 1. Boiler master fuel trip and turbine trip relays
 2. Generator trip relays and turbine trip relays
 3. Generator trip relays and 765kV kV circuit breaker
 4. Generator trip relays and generator field breaker.
 5. Generator trip relays and UAT breaker.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

iii) 1.1 KV Grade Control Cable

1. Control cable shall be multi core, minimum 2.5 sq.mm cross section, stranded copper conductor, PVC insulated, inner PVC sheathed / galvanized steel wire armored and outer sheath made of FRLS PVC compound. In situation where accuracy of measurement or voltage drop in control circuit, warrant, higher cross sections as required shall be used. 4 sq.mm copper conductors shall be used for CT circuits, all other specification remaining same. In 4 sq.mm conductor impose unacceptable high burden on CTs, higher cross section of conductor shall be used.
2. Voltage Transformer leads shall be checked for voltage drop, which shall be limited to within 1 % for all cases other than tariff metering, for which the voltage drop shall be limited to 0.2 %. In case the voltage drop with 4 sq.mm Cu conductors exceeds this value, higher conductor sizes shall be used.

iv) 1.1kV Copper Conductor Fire Survival Control Cables

1. Conductor shall be of stranded construction, consisting of high conductivity annealed tinned copper conductors conforming to IS 8130/1984 amended up to date.
2. A suitable heat barrier tape, preferably glass mica tape shall be provided over the conductor.
3. The conductor insulation shall consist of heat resisting elastomeric material EPR (Ethylene Propylene rubber) and shall conform to Type IE-2 of IS:6380/1984 amended up to date.
4. An inner sheath of extruded special low smoke and very low halogen content (acid gas generation shall be less than 2% by weight) elastomeric (HOFR) compound of black colour or any other natural colour with prior approval from Owner conforming to Type SE-3 of IS-6380/1984, amended up to date, shall be provided over the laid up cores.
5. The armouring over inner sheath shall consist of single layer of wire/round galvanized steel wire as per IS 3975 amended up to date.
6. The outer sheath shall be of special low smoke and very low Halogen content (Acid gas generation shall be less than 2% by weight) elastomeric HOFR compound comprising of synthetic rubber and shall generally conform to the type SE-3 of IS: 6380 latest revision.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

7. The colour of outer sheath shall be black or any other natural colour agreed mutually between Owner and Contractor.
8. The minimum sizes of L.T. cable to be chosen are as below:
 - a. Al – 16 Sq.mm (3 core)
 - b. Cu – 2.5 Sq.mm (3 core)
9. In power cables maximum conductor size to be used will be 300 sq. mm & 630 sq.mm for multi core and single core cables. In case of multi core cables not more than 3 runs to be used or otherwise single core cable to be used.

v) Cable Drums

Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

2.2.16.5 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

- i) Cable datasheets
- ii) Cable sizing
- iii) QAPs & Test Reports.
- iv) Relevant catalogues

2.2.16.6 Tests

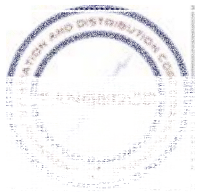
i) Type Tests

a. For Conductor

- i. Annealing test - For copper conductor only.
- ii. Tensile test - For aluminium conductor only.
- iii. Wrapping test - For aluminium conductor only.
- iv. Resistance test.

b. For Armour Wires/ Formed Wires

- i. Measurement of Dimensions.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii. Tensile Test - For aluminium wires only
- iii. Elongation test - For aluminium wires only
- iv. Torsion test - For round wires only.
- v. Winding test - For Formed wires only.
- vi. Resistance test.
- vii. Zinc Coating test - For G.S. Formed wires /wires only.
- viii. Wrapping test - For Al. Formed wires /wires

c. For XLPE insulation & PVC Sheath

- i. Test for thickness.
- ii. Tensile strength & elongation tests before ageing and after ageing.
- iii. Ageing in air oven.
- iv. Loss of mass test - For PVC sheath only.
- v. Hot deformation test - For PVC sheath only.
- vi. Heat shock test - For PVC sheath only.
- vii. Shrinkage test .
- viii. Thermal stability test - For PVC sheath only.
- ix. Hot set test - For XLPE insulation only.
- x. Water absorption test - For XLPE insulation only.
- xi. Oxygen index test – For outer sheath only.
- xii. Smoke density test - For outer sheath only.
- xiii. Acid gas generation test - For outer sheath only.

d. For completed cables

- i. Insulation resistance test (Volume resistivity method)



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii. High voltage test
- iii. Flammability test as per clause "Flammability test" of IEEE - 383 .
- iv. Flammability test as per IEC - 332 Part-3 (Category -B).
- v. Test for rodent & termite repulsion property.

ii) Flammaability Test

1. This test shall generally be carried out as per IEEE 383. The cable installation to be tested shall consist of as many cables as are necessary to give atleast 10 kg of organic material per metre run.
2. The following cable installation shall be tested :
Installation with single / multi core cables in touching formation.
3. Size of cables, number of cables, number of layers and laying arrangements for each installation shall be subject to Owner's approval.
4. The size of the cables selected (measured by total cross sectional area of the conductor) shall have maximum organic material per sq. mm of total cross sectional area of all the conductors.

iii) Acceptance Tests

Acceptance tests shall be carried out on each type and size of the cables on the cable drums selected at random as per following sampling plan:

Sl.no	No. of drums in the lot	No. of drums to be taken as sample
	Upto 100	10% (Subject to minimum of 1 drum)
	101 to 300	13
	301 to 500	20
	Above 500	32

The following shall constitute acceptance tests:

1. Item No. 1 to 14, 16, 19, 20, 22, 23, 24, 25 of list of type tests specified in cluase 2.2.15.5.1.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Fire resistance test as per SS 4241475 (F3 category).
3. One length per size / lot for surface finish and length measurement.
4. Lay length / sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Band marking.

iv) Routine Tests

Routine tests shall be carried out as per relevant standard for each drum of cables of all types and sizes.

Cabling System



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.17 CABLING SYSTEM

2.2.17.1 SCOPE OF WORK

The scope of work covers supply, erection, testing and commissioning of complete electrical system including cabling, fire stop mortar seal, fire retardant cable coating system etc. the scope shall broadly cover, but not be limited to:

- i) TG Building & Transformer Yard
- ii) Boiler Area, ESP
- iii) All auxiliary buildings (including electrical rooms of respective buildings) and structures as per details in the general electrical specification/ plot plan & related drawings.
- iv) Service Building
- v) CPU Regeneration
- vi) DG House
- vii) Pipe cum cable rack (within the battery limits).
- viii) Air Washer Units
- ix) All electrical equipment as described in different sections.
- x) As built drawing for all above systems on completion of project.

The scope of work shall also include all civil and structural works necessary for successful installation, commissioning & commercial operation of all electrical equipment to be erected under this specification.

2.2.17.2 SCOPE OF SUPPLY

- 1 The scope of work shall include complete supply, installation, testing, commissioning and putting into successful commercial operation of the cabling system for the entire plant covering all indoor & outdoor areas of BTG area.
- 2 The equipments and materials within the scope of supply shall include but not limited to
 - i. Power & control cabling works (including that of special cables):
Supply and installation of cable and cable trays/raceways, supports, conduits, duce bank, cable accessories such as jointing/termination kits, cable glands, lugs, ferrules, etc. as required for all the systems & equipments.
 - ii. Supply and installation (including laying & termination) of control cables, special cables, instrumentation cables for all equipments and systems.

**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III****EPC TENDER SPECIFICATION FOR BTG PACKAGE**

- iii. Supply and installation (including laying & termination) of all power cables (HV and LV) of all power cables (HV and LV) for all equipments and systems.
- iv. Cable routing has to be planned such that it shall not cross the steam lines, oil lines.
- v. Fire Sealing Arrangement: All cable entries into the panel (HV & MV & LV SWGR panels) should be provided with fire sealing arrangements.
- vi. Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be sealed by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire
- vii. Galvanized steel rigid/ flexible conduits and accessories, ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes, cable fixing clamps, nuts & bolts etc as required.
- viii. All necessary erection materials, consumables and sundry items including arc welding rods to complete the installation for satisfactory and trouble free operation.
- ix. Any item of works or erection materials which have not been specifically mentioned but are necessary to complete the work involved shall be deemed to be included in the scope of this specification and shall be furnished by the Bidder without any extra charge to the purchaser.

2.2.17.3 CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.

IS:513	Cold rolled low carbon steel sheets and strips.
--------	---



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

IS:1079	Hot Rolled carbon steel sheet & strips
IS:1239	Mild steel tubes, tubular and other wrought steel fittings
IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS:9537	Conduits for electrical installation.
IS:9595	Metal – arc welding of carbon and carbon manganese steels - recommendations.
IS:13573	Joints and terminations for polymeric cables for working voltages from 3.3kv up to and including 33kv performance requirements and type tests.
BS:476	Fire tests on building materials and structures
DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors
VDE 0278	Tests on cable terminations and straight through joints
BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.
	Indian Electricity Act.
	Indian Electricity Rules.

Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

2.2.17.4 DESIGN AND CONSTRUCTIONAL FEATURES

1 Inter Plant Cabling



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Interplant cabling for main routes shall be laid along overhead trestles/duct banks. However, from tap-offs, same can be through shallow trenches with sand filling. All the switchgear room shall be provided with cable spreader room at ground floor. The cable trenches are allowed between switchyard control room and transformer yard only. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering.

2 Transformer yard

In transformer yard cables shall be laid in RCC concrete trenches with RCC covers. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles/duct banks. Minimum clear height of trestle shall be 3 m and for Rail/road crossing, it shall be as per rail/road crossing norms. False floors are not to be provided for cabling purpose.

3 Cable entry

Cable entry from outdoor underground/cable routes to the buildings, if any, shall be above the finished floor level of the building.

All Buildings shall have suitable cable spreader rooms /cable vaults.

4 Trenches

PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.

No sub-zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant areas.

All field switches for equipments corresponding to a stream located within a radius of 4-5 m shall be wired out to a field junction box and from field junction box to control panel/Input – Output cabinet by screened instrumentation cables.

Cable trenches shall be provided in Transformer Yard and Switchgear/MCC rooms. In other areas local cable trenches with length not exceeding 5 metres are allowed just near the equipment.

Cables for one set of auxiliaries such as ID,FD & PA fans & half of the coal mills shall be routed in one route & for through other set of auxiliaries through other route.

Bidder shall provide two independent routes for cables between Switchyard Control Room & Main Plant Control Room. Bidder shall provide the cable trays along with its supporting structure arrangement on the trestle.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

5 Cable Vault:

- i) Cable vault of not less than 3.5 metres clear height shall be provided.
- ii) Clear access passage of at least 750 mm wide & 2.0 Mts clear height shall be provided at entrances & along cable ways. Wherever the passage is through cable routes clear height shall not be less than 1.5 Mts.
- iii) Cable vaults shall be provided with adequate drainage facility for drainage of fire water.
- iv) Each cable vault should have two fire proof doors.
- v) Exit signs shall be provided near doors for personnel escape in case of emergency.

- 6 Major routes in Turbine area (STG Package area) shall be on overhead cable trays either supported from available structures, building structure. Only in specific areas as shall be approved by purchaser/consultant where number of cables are too small compared to the route length and in transformer yard, cable shall be routed in cable trenches.

2.2.17.5 EQUIPMENT DESCRIPTION

Cable trays, Fittings & Accessories

- 1 Cable trays shall be ladder type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.), accessories (like side coupler plates, etc.) and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.
- 2 These shall be either prefabricated hot dip galvanized sheet steel trays or site fabricated angle iron trays free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.
- 3 Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Minimum thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be minimum 3 mm.
- 4 Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of minimum thickness 2 mm and shall be hot dip galvanized as per relevant IS. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.
- 5 Prefabricated hot dip galvanized sheet steel cable trays shall be used for maximum support span of 2000 mm unless design is approved for larger span. Cable trays shall be suitable for a cable weight of 100 kg/meter running length of tray. Minimum thickness of sheet steel/galvanizing shall be 2mm/86 microns respectively. The



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

amount of zinc deposit shall not be less than 610 gm per square meter.

- 6 Cable trays fabricated from standard rolled sections shall be 50x50x6/75x75x6 sections for runners for supporting spans limited to 2000 mm/more than 2000 mm respectively. Cross support shall be 32x6 mm / 50x6 flat for widths up to 500mm/more than 500mm respectively.
- 7 Separate coloured paint strips 2 inch width each numbers equally spaced at 5 metres interval shall be applied for identification of different type of trays depending upon types of usage/applications/area as below:

High/ medium voltage cables:

11kV/6.6kV : red strips

1.1kv power cables : yellow strips

1.1kv control cables : blue strips

Instrumentation cables : green strips

8 Support System for Cable Trays

Cable tray support system shall be pre-fabricated similar or equivalent to "Unistrut make".

Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types:

- (i) C1:- having provision of supporting cable trays on one side and
- (ii) C2:- having provision of supporting cable trays on both sides. The support system shall be the type described hereunder
 - a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardware such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.
 - b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardware's fittings and accessories shall be prefabricated factory galvanised.
 - c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanized surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied.
- d. All steel components, accessories, fittings and hardware shall be hot dip galvanized after completing welding, cutting, drilling and other machining operation.
 - e. The main support channel and cantilever arms shall be fabricated out of minimum 2.5 thick rolled steel sheets conforming to IS.
 - f. Cantilever arms of 300 mm, 600 mm and 750 mm in length are required. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.
 - g. Cable trays in areas subjected to excessive coal dust or mechanical damage shall have hot dip galvanized sheet steel metal trays cover installed on front tray in vertical run and inverted 'V' type on upper tray in horizontal run with consideration for ventilation.

The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above are indicative only. Nevertheless, the support system shall be designed by the contractor to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Contractor without any additional cost. The contractor shall submit the detailed drawings of the system offered by him along with the bid.

9 FRP CABLE TRAYS

FRP Cable trays shall be used for areas like intake raw water pump house, Desalination plant, CHP, Battery room, NDCT and chemical house.

Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc. shall be of FRP.

The FRP cable tray shall be ultra violet resistant. FRP cable trays shall be manufactured in accordance with NEMA FG-1-1984-1993 and Standards IS-6746 and ASTM E 84. Manufacturing process shall be pultrusion using automated pultrusion machines. Resin to be used shall be ultraviolet resistant polyester resin.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All cable trays and accessories shall be corrosion / chemical resistant, weather resistant, easy to drill and cut. Lightweight, high strength and flame retardant in accordance with ASTM E-84-Class 1 Rating and as per IS-6746-Very Low Flammability. An additive material shall be mixed with the FRP to make them resistant to ultraviolet light. The oxygen index shall be minimum 30 as per ASTM-D-2863.

The minimum glass content in the FR material shall be 55%.

The Ladder type trays shall have side rails and horizontal rungs. Both of these shall be of same material i.e. the FRP with additive material. The rungs shall be placed 300 mm apart from each other. The side runner of the Ladder type FRP cable trays shall be pultruded FRP channel of 100 x 35 mm height. The minimum thickness of the tray will remain 4mm. The rungs to side member are connected to the Larger portion of the side rail by using pin made of fiberglass reinforced thermoplastic, and should have both mechanical and adhesive lock.

Minimum thickness of perforated type FRP cable tray shall be 4mm. Minimum thickness of coupler plates shall be 4mm.

HV, MV and LV power single core cable shall be laid in trefoil formation with 2D gap where 'D' is the diameter of cable.

HV & MV cables and LV power cables (95 sq. mm & above) multicore cables shall be laid in touching formation in single layer. 1100V multicore cables below 95 sq. mm shall be laid in two layers. Control and instrumentation cables shall be laid in 3 layers.

- i) Individual tray systems shall be established for the following services: -
 - a) 6.6 kV and higher voltage power cables.
 - b) 415 Volt power cables.
 - c) Special noise-sensitive circuits or instrumentation cables.
 - d) Control cables. (Control cables shall be laid along with LV power cables and instrumentation cables if required for short length near the equipment with GI separators).
 - e) Further subdivision of tray systems shall be provided if required to meet special segregation/separation requirements.
- ii) In areas having coal dust, cable trays shall be run in vertical formation while horizontal trays shall be provided in other areas. Cable depth not to exceed two cables for vertical trays.
- iii) The minimum design vertical spacing for trays shall be 300 mm measured from the bottom of the upper tray to the top of the lower tray. At least a 250 mm clearance shall be maintained between the top of a tray and beams, piping, or



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

other obstacles to facilitate installation of cables in the tray. A working space of not less than 600 mm shall be maintained on at least one side of each tray. Tray covers shall be provided on the top most tray of each tier of cable trays.

10 Pipes, Fittings & Accessories

Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria

GI Pipes shall be of medium duty as per IS: 1239

Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.

11 Junction Boxes

Junction Boxes shall comprise of a case with hinged door constructed from cold rolled sheet steel of minimum thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3 mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.

Glass Fibre Reinforced Junction Boxes No. of Ways: 12/24/36/48 with 20% spares terminals.

Junction boxes shall be Glass Fibre Reinforced with saturated polyester conforming to standards like DIN 16911 type 803/16913 type 834, 5 self extinguishing in accordance with ASTM D635/UL 94 VO. Junction boxes for use in outdoor or damp locations shall be sturdy construction. Temperature resistance shall be between – 10 to 100°C. Impact resistance shall be greater than 7 Nm, (EN 50014). Protective insulation shall be in line with VDE 0100, dielectric strength shall be greater than 10 KV/mm, halogen free toxicity, the enclosure and door cover shall be painted and electro statically power coated (preferably in RAL7032). Earth connection (studs size shall be M 6) shall be provided on the cover as well as door.

Protection Class

Protection Category shall be IP 66 to EN 60529. There shall be guaranteed perfect seal to meet Protection class IP 66 providing arrangement like highly elastic foamed in special type seal like polyurethane/chloroprene. The sealing rubber shall not have aging effect and shall retain its sealing characteristics for more than 20 years. Contractor shall indicate this in data sheet. The rubber seal should be pasted at its



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

place with pasting technology for like more than 20 years (double sealing arrangement is preferred).

Mounting clamps and accessories

Junction boxes shall be suitable for mounting on walls, columns and structure. Brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass. The accessories like mounting plates etc. of steel shall be powder coated. The support rails for terminal box shall be zinc coated.

General

1. JBs shall have small canopy at the top.
2. There shall be rainwater collection arrangement from top and side of the outer ages to ensure that any leakage into the junction box shall be avoided and it shall fall outside.
3. Cable entry shall be from bottom side only.
4. Ensure gland plate sealing perfect. It shall be of the same quality and arrangement as that of door to cover arrangement.

Steel Junction Boxes

No. of Ways 12/24/36/48 with 20% spares terminals.

Junction boxes shall be designed in accordance with NEC, article 370, paragraph 18, 19 & 20 or equivalent standards.

Enclosure

Junction boxes for use in outdoor or damp locations shall be sturdy steel construction. The enclosure and door cover shall be surface finished clean, degreased, phosphated, deep coated primed (preferably in RAL 7044) and electrostatically powder coated (preferably in RAL 7032). Earth connection (studs size shall be M6) shall be provided on the cover as well as door. The sheath steel thickness shall be more than 2 mm.

Doors

The doors shall be hinged and lockable. The doors shall have industrial heavy duty hinges. The doors shall be easily but firmly lockable with quick release fastener and with integrated viewing window of 3mm resistant plexi glass or equivalent. The doors shall be industrial heavy duty hinges. The doors shall be easily but firmly lockable with quick release fastener.

Junction boxes shall be provided with two nos. earthing terminals (externally available) suitable for connection of 8 SWG G.I. wire. Knockouts shall be provided at bottom and both sides. These shall be provided by fixing plates in order to make



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

them detachable type with suitable neoprene gaskets. Bottom and side plates for cable/conduit connection shall be provided. All unused holes shall be sealed with suitable grommets.

Junction boxes shall be provided with external designation label. The label inscriptions shall be informed to the Contractor by the Owner. Junction boxes shall be provided with danger sign in case of 415V circuit.

Junction boxes shall be of two types, viz. One suitable for control cabling and the other suitable for power cabling.

Junction boxes for control cabling shall have 24 way/ 48 way terminal blocks suitable for up to 2.5 sq.mm. Cu. Cable. However, for instrumentation junction boxes there shall be 24/48 ways suitable for terminating cable of 0.5 sq.mm. Cu. Cable.

Junction boxes for power circuit cabling shall be suitable for 1 no. 3 core 16 sq.mm.AL. Incoming cable and 1 no. 3 core 2.5 sq.mm Cu. Outgoing cable.

12 Terminal blocks

Terminal blocks shall be 650 volts grade, rated for 10 Amps and in one piece, rigid, Bakelite moulded, with disconnecting /shorting link. It shall be complete with insulating barriers, Klip-on-type terminals and identification strips, terminal studs, washers, nuts, lock nuts, marking strips etc.

Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be Elmex type CSLT-1 with insulating material of Melamine conforming to ESI Standard 12.1 or equivalent. Cage clamp type terminal block suitable for terminating 2 wires of 2.5 sq mm. on both sides arranged to facilitate easy termination shall be provided. 20% spare terminals shall be provided

13 Terminations & Straight through Joints

Termination and jointing kits for 11/6.6 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be pre-moulded type, taped type or heat shrinkable type. 11/6.6 kV grade joints and terminations shall be type tested as per IS: 13573. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solder less crimping type cable lugs & ferrule as per DIN standard.

Straight through joint and termination shall be capable of withstanding the fault level for 33kV, 11 kV and 6.6 kV systems.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.1 KV grade straight through joints shall be of proven design.

14 Cable glands

Cable glands shall conform to BS: 6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene and of tested quality. Necessary cable dimensions shall be furnished to the successful contractor.

Cable glands shall be single compression for indoor use, double compression type for outdoor use. Glands for classified hazardous areas shall be double compression type flameproof and weather proof duly certified by CMRS and approved by CCE.

15 Cable lugs/ferrules

The cables lugs shall be conforming to IS: 8309.

Machine ferruling shall be adopted.

Cable lugs for power cables shall be Aluminium solder less crimping type suitable for aluminium compacted conductor cables.

The cable lugs for control/instrumentation/ telephone cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments.

Cable lugs shall be suitable for termination of different cross-sections of control/instrumentation /telephone cables and shall be of following types.

- i) Copper tubular terminal end for solder less crimping to copper conductors.
- ii) Cable lugs for control cable termination shall be insulated type. These lugs shall be flat type/ring type/U type to suit the terminals provided in the pan
- iii) Pin type lugs shall not used.
- iv) Aluminium tubular terminal ends for solder less crimping of to Aluminium conductor. Solder less crimping of terminals shall be done by using corrosion inhibiting compound. The cable lugs shall suit the type of terminals provided on the equipment. Lugs for control/instrumentation cables shall be PVC insulated/sleeved type.

**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

16 Cable Clamps & Straps

The cable clamps required to clamp multicore cables on vertical runs shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables on horizontal trays, self-locking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the system short circuit current of 105 KA peak.

17 Galvanizing

Galvanizing of steel components and accessories shall conform to IS: 2629 & IS: 2633. Additionally galvanizing shall be uniform, clean smooth, continuous and free from acid spots

The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS: 1367. The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified.

18 Welding

The welding shall be carried out in accordance with IS: 9595. All welding procedures and welders qualification shall also be followed strictly in line with IS: 9595

2.2.17.6 INSTALLATION

1 Cable tray and Support System Installation

Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures. All cable trays shall be in vertical configuration in boiler, CHP & ESP areas. Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 1500 mm. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per relevant Standard. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated in the relevant



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

approved tray layout drawings.

All cable way sections shall have identification, designations as per approved cable way layout as and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/ stenciled with identification numbers at every floor.

In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. In such cases the Contractor shall fabricate at site suitable sections of trays, supports and accessories to make the installation complete for the specific purpose after obtaining owner's prior approval, which shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.

2 Conduits/Pipes/Ducts Installation

- (a) The Contractor shall be fully responsible for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
- (b) GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
- (c) Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material.
- (d) Cable routing between lined cable trench and equipment/motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 150 to the trench wall. In case of larger dia cables i.e. 50mm and above, adequately sized pipe with larger bend radius shall be provided for ease of drawing of cable or for replacement. In places where it is not possible, a smaller trench may be provided if approved by Site Engineer.
- (e) Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Conduit /pipe size (dia).	Spacing
Up to 40 mm	1 M
50 mm	2.0 M
65-85 mm	2.5 M
100 mm	3.0 M

- (f) In areas like WTP, chemical handling, battery room etc. exterior surface of the conduits shall be further coated with chromate or polymer for better resistance to corrosion.
- (g) All G.I. pipes shall be laid as per approved layout drawings and site requirements.
- 1 Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the contractor), all the burrs from the pipes shall be removed. The bends formed shall be smooth. GI Pipes with bends shall be buried
 - 2 in oil/concrete in such way that that the bends shall be totally concealed. For GI pipes shall be undertaken well before paving is completed and necessary co- ordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. plugs after they are laid in final position. G.I. plugs shall be supplied by the contractor at no extra cost.

3 Junction Boxes Installation

Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the approved drawings or as decided by Owner and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.

4 Cable Laying and Installation

- 1) Cable network shall include power, control, lighting, communication and fire alarm system cables, which shall be laid in trenches, cables trays/conduits as detailed in the approved drawings and cable schedules. Erection of cable trays and aligning and leveling as required shall be the responsibility of the contractor.
- 2) Cable installation shall be carried out as per IS: 1255 and other applicable standards.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

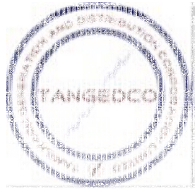
- 3) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.

- 4) Laying of cables directly buried in ground is not acceptable.

- 5) For coal handling plant the cables shall not be routed along conveyor galleries. The cables shall be routed on independent cable trestles. All tray levels shall be checked after erection and marked in as built drawings. Cable routing given on the layout drawings shall be checked in the field to avoid interference with structures, heat sources, drains, piping, air-conditioning duct etc. and minor adjustments shall be done to suit the field conditions wherever deemed necessary. All tray runs shall be installed parallel to the trench/building walls and floors except otherwise noted in the approved drawings. The contractor shall have to secure rack/tray supports by welding to those inserts or other available building steel surfaces. Outdoor trays shall be installed by welding on the steel/concrete structure with inserts by the contractor. As far as practicable, cable trays shall be supported from one side only in order to facilitate installation and maintenance of cables from the other side.

- 6) While laying cable, ground rollers shall be used at every 2 metre interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables.

- 7) All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 8) Cables installed above grade shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel or at right angles to beams, walls columns. Cables shall be so routed that they will not be subjected to heat from adjacent hot piping or vessels.

5 Laying of cables in cable trays

- 1) Cables shall be laid on cable trays strictly in line with cable schedule furnished. Where specific cable layouts are not shown on approved drawings, contractor shall route these as directed by the Owner.
- 2) Power and control cables shall be laid on separate tiers. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.V. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two metre. All multicore cables shall be laid in touching formation. LT power cables above 95 sq.mm size shall be laid in single layer touching formation in trays while cables upto & including 95 sq.mm shall be laid in maximum of 2 layers. Control and Instrumentation cables can be laid upto a maximum of three layers in each tray.
- 3) All communication cables (telephone, P.A. System) RTD Cables shall run on instrument trays/ducts/trenches. Wherever these are not available, cables shall be taken in a separate trench/trays with a minimum clearance of 600mm away from electrical trench/trays as per the direction of Site Engineer and Communication cables shall cross power cables at right angles
- 4) Power and control cables shall be secured fixed to trays/support with self locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.

Bending radii for cables shall be as per manufacturer's recommendations and IS1255.

- 5) Individual cables or small groups which run along structures/walls etc will



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

be clamped by means of 16 SWG GI saddles on 25x6mm saddle bars. The cost of saddle and saddle bars shall be deemed to have been included in the installation of cables. Alternatively small group of cables can be taken through 100mm slotted channel/ISMC 100. They shall be rightly supported on structural steel and masonry, individual or in groups as required, if drilling of steel must be drilled where the minimum weakening of the structure will result.

- 6) Cables shall be supported so as to prevent unsightly sagging. In general distance between supports shall be approximately 300mm for cables upto 25mm diameter and maximum 500mm for cables larger than 25mm dia and cables laid in vertical run of cable trays shall be clamped at an interval of 900mm.
- 7) Where cables cross roads/rail tracks, the cables shall be laid in Hume pipe/PVC pipe.
- 8) At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
- 9) Power and Control Cables, as far as possible, shall be laid in complete, uncut lengths from one termination to the other. Straight through joints in power cable shall be allowed only in nearest of rare situation only after approval of owner.
- 10) Joints for less than 250 Meters run of cable shall not be permitted.
- 11) In each cable run some extra length shall be kept at suitable point to enable one LV/two HV straight through joints to be made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
- 12) Wherever few cables are branching out from main trunk route troughs shall be used.
- 13) Cables shall be neatly arranged in the trenches/trays in such a manner so that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the contractor.
- 14) The contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site and avoiding interference with structure, foundation, pipelines or any other works. Before the start of



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

cable laying, cable drum schedule shall be prepared by electrical contractor and get that approved by site engineer to minimize/avoid straight through joints. The actual number of straight through joints required shall be worked out by the contractor. During the erection period the contractor shall furnish a monthly report on cable position in an approved proforma so as to keep the owner apprised of the position.

- 15) The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.
- 16) Minimum number of spare cores required to be left for interconnection in control cables shall be as cl.3.07.00, chapter 16. Electrical cable trays exposed to hazardous process fluid shall be covered with detachable G.I. covers. The covers shall be suitable to resist wind forces.
- 17) For cables laid above ground in cable racks, asbestos sheeting of 3mm thickness shall be provided below the bottom cable tray to protect the cables from fire.
- 18) Supporting steel shall be painted before laying of cables. The painting shall be done with one coat of red lead paint and two coats of approved bituminous aluminium paint unless otherwise specified.
 - a) Separation
 - b) Sufficient spacing not less than 300 mm shall be provided between different tiers of trays and the same shall be maintained to permit adequate access for installation and maintenance of cables.
 - c) At least 300mm clearance shall be provided between HV power & LV power cables, LV power & LV control/instrumentation cables,
 - d) Segregation
 - e) Segregation means physical isolation to prevent fire jumping.
 - f) Cables from two different services viz. supply from Station Board and Unit Board shall be segregated.
 - g) Interplant cables of station auxiliaries and unit critical drives shall be



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

- h) For Coal Handling Plant all the cables of one stream shall be segregated from the cables of the other stream and shall run on either side of the trestle.

6 Cable fire sealing

- i) Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be sealed by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire.
- ii) Wherever the cables/cable trays pass through walls/floors, fire proof cable penetration seals rated for one hour shall be provided. This shall be by suitable block system using individual blocks with suitable framework or by silicon RTV foaming system. In case foaming system is offered, damming board, if used, shall not be considered for fire rating criteria. Any of the system offered shall be of proven type as per BS: 476 (Part-20) or equivalent standard.
- iii) In order to prevent fire propagation through cable penetrations, after laying, dressing & clamping of cables, all the openings shall be properly sealed by using Fire Stop Mortar Seal and Fire Retardant Cable coating compound. Also the cable runs both before and after the fire scale shall be suitably sprayed with anti-fire propagation liquid.

7 Cable laying in trenches between switchyard and Transformer yard

- 1 RCC cable trenches with removable covers will be provided by the contractor. Cables shall be laid in 3 or 4 tiers in these trenches. Concrete cable trenches shall be filled with sand where specified to avoid accumulation of hazardous gases. RCC covers of trenches in process area shall be effectively sealed to avoid ingress of chemicals etc. Removal of concrete covers for purposes of cable laying and reinstating them in their proper positions after the cables are laid shall be done by the contractor at no extra cost.

For cable trays are laid in trench in more than two tiers a space of minimum 600 mm shall be available for maintenance. In case two or



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

more tiers of cable trays are running parallel along both sides of trench walls there shall be space of minimum 600 mm between them.

Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cable leaving trenches shall be coiled and provided with a protective pipe or cover till such times the final termination to the equipment is completed.

- 2 Prior to laying of cables inside trenches, the contractor shall properly clean inside of those trenches.
- 3 When cables are laid in multiple tiers, spacing between individual tiers shall be as approved by Site Engineer. Space between individual tiers shall be filled and compacted with soil and sand.
- 4 As each row of cables is laid in place and before covering with sand every cable shall be given on insulation test in the presence of Site Engineer. Any cable, which proves defective, shall be replaced before the next groups of cables are laid.
- 5 All wall openings/pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water inside building/lined trench.
- 6 Where cables rise from trenches to motor, control station, lighting panels etc., they shall be taken in G.I. Pipes for mechanical protection up to a minimum of 150mm above grade.
- 7 Cable ends shall be carefully pulled through the conduit, to prevent damage to these cables. Where required, approved cable lubricant shall be used for this purpose. Where cable enters conduit the cable should be bent in large radius. Radius shall not be less than the recommended bending radius of the cables specified by the manufacturer.

Following guide of the pipe fill shall be used for sizing the pipe size:

1. 1 Cable in pipe - 53% full
2. 2 cables in pipe - 51% full
3. 3 or more cables - 43% full
4. Multiple cables - 40% full.

After the cables are installed and all testing is complete, conduit ends above grade shall be plugged with a suitable weatherproof plastic compound/'PUTTI' for sealing purpose. Alternatively, G.I. Lids or PVC bushes shall be employed for sealing purposes. The cost for the same shall be deemed to have been included in the installation of G.I. pipe and



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- no separate payment shall be allowed.
- 8 Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Site Engineer before cutting is done.

2.2.17.7 CABLE IDENTIFICATION

1. Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry & exit, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties of 'TY-CAB' or equivalent type with cable number heat stamped on the cable tags.
2. If laying of underground cable is specifically agreed by Owner as a special case then the underground cables shall be provided with identity tags of Stain less steel securely fastened every 30 M of its underground length with at least one tag at each end before the cable enters the ground. In unpaved areas cable trenches shall be identified by means of markers. These posts shall be placed at location of changes in the direction of cables and at intervals of not more than 30 M for straight run and at cable joint locations with additional inscription 'Cable Joint'. For buried cables the marker shall project 150mm above ground.
3. Drum number of each cable from which it is taken shall be recorded against the cable number in the cable schedule.

2.2.17.8 CABLE TERMINATIONS & CONNECTIONS

1. The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer's instructions, drawings and/or as directed by Site Engineer. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Engineer in charge of TANGEDCO.
3. Responsibility of proper termination shall lie on the contractor. Guarantee for termination shall also have to be given by the contractor.
4. The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.
5. Contractor shall drill holes for fixing glands wherever necessary at no extra cost. Gland plate shall be of non-magnetic material/aluminium sheet in case of single core cables. If the cable end box or terminal chamber provided on the equipment is found unsuitable and requires major modifications the same shall be carried out by the contractor at the discretion of the Engineer- in-Charge.
6. Control cable cores entering control panel/switchgear/MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.
7. The panels where a larger number of cables are to be terminated and cable identification may be difficult, each core ferrule shall include the complete cable number. The ferrules shall be indelible interlocking type and shall fit tightly on cores. Spare cores shall have similarly ferrules with a suffix letter 'S' alongwith cable numbers and coiled up after end sealing.
8. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
9. It is the responsibility of the Contractor to terminate the cables at motor terminals in correct phase sequence to ensure the proper direction of rotation.
10. All cables upto 1.1KV grade shall be terminated at the equipments by means of compression type cable glands. They shall have a screwed



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

nipple with conduit electrical threads and check nut.

11. All cable entries shall be through bottom only and top entry terminations are made only after getting approval of Site Engineer.
12. Power cables, wherever colour coding is not available, shall be identified with red, yellow and blue PVC tapes. Where copper to aluminium connections is made, necessary bimetallic washers shall be used. For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the Switchgear/Control panels and Control Switches.
13. In case of control cables all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules. Wire numbers shall be as per schematic/ wiring/ inter-connection diagram. Contractors shall have the samples of PVC markers approved before starting the work. All unused spare cores of control cables shall be neatly bunched and ferruled with cable tag at both ends. Control cables shall be neatly bunched and served with PVC perforated tape to keep it in position at the terminal block.
14. Where threaded cable gland is screwed into threaded opening of different size, suitable brass threaded reducing bushing shall be used provided.
15. The cable shall be taken through glands inside the panels or any other electrical equipment such as motors. The individual cores shall then be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Only control cables of single strand and lighting cables may be directly terminated on to the terminals. In case of termination of cables at the bottom of a panel over a cable trench having no access from the bottom, close fit hole should be drilled in the bottom plate for all the cables in one line, and then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables it should be sealed with cold setting compound. Cables shall be clamped over the open armouring to connect it to earth bus.
16. Cable leads shall be terminated at the equipment terminals by means of crimped type solder less connectors. Crimping shall be done by hand crimping/hydraulically-operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping. Conductor surface shall be cleaned and shall not be left open the terminals.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

17. All cable entry points shall be properly sealed and made dust and vermin proof.
Unusual opening, if any, shall be effectively closed. Sealing work shall be carried out with approved sealing compound having fire withstand capability for at least three hours.

18. Cable accessories for H.V. Systems

1. The H.V. cables terminations/joints shall be done by skilled, certified and experienced jointers duly approved by the Site Engineer.
2. The termination and straight through joint kits for use on high voltage system shall be suitable for the type of cables offered by the contractor or the type of cables issued by owner for installation. The materials required for termination and straight through joints shall be supplied in kit form. The kit shall include all insulating and sealing materials apart from conductor fittings and consumable items. An installation instruction shall be included in each kit.
3. The termination kits shall be suitable for termination of the cables to an indoor switchgear or to a weatherproof cable box of an outdoor mounted transformer/motor. The termination kits shall preferably be as of the following types.
 - a. 'PUSH ON' type for LV cables.
 - B Heat-shrinkable sleeve type for LV & HV cables.

However, termination kits for HV cables shall be of Heat Shrinkable type of makes with specific approval of owner.
For outdoor installations, weather shields/sealing ends and any other accessories required shall also form part of the kit.
4. The straight through jointing kits shall be suitable for underground buried installation with uncontrolled backfill and possibility of flooding by water. The jointing kit shall be one of the following types.
 - a. 'TAPEX' of M-seal make or equivalent for LV cables
 - b. Heat-shrinkable sleeve type for LV & HV cables.

However, termination kits for HV cables shall be of Heat Shrinkable type of makes with specific approval of owner. For outdoor installations, weather shields/sealing ends and any other accessories required shall also form part of the kit.

2.2.17.9 QUALITY ASSURANCE PROGRAMME

Contractor shall furnish detailed Quality Assurance Programme and Quality Plans for all materials and accessories to be supplied and installed under the



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

scope of the specification as per General Technical Conditions of technical specification. The Quality Plans shall include all tests/ checks as per relevant National/International Standards and the requirements of this specification including tests listed in this section.

2.2.17.10 LIST OF TESTS TO BE CONDUCTED

1 Type tests on Cable Trays support system

a) Test 1A

On main support channel type-C2 for cantilever arms fixed on one side only.

A 3.5 metre length of main support channel shall be fixed vertically at each end to a rigid structure as per appropriate fixing arrangement. Eight (8) nos. 750 mm cantilever arms shall be fixed to the main channel and each arm shall be loaded over the outboard 600 mm with a uniform working load of 100 kg. Subsequently a point load of 100 kg shall be applied on arm 2. A uniform proof load on all the arms equal to twice the working load shall be then be applied. Deflections shall be measured at the following load intervals and other necessary points:

- a) Working load
- b) Working load + point load
- c) Off load
- d) Proof load + point load
- e) Off load

The deflection measured at working loads shall not exceed 16 mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied.

- b) Test 1B: Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2

On Main support channel type -C2 for cantilever arms fixed on both sides

- a) **Test 2A:** A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per appropriate fixing arrangement. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

of twice the working load on all the arms; deflection shall be measured at the following load intervals and other necessary points.

- i) Working load
- ii) Working load + Point load
- iii) Off load
- iv) Proof load + Point load
- v) Off load

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied

- b) Test 2B:** The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side.

- c) Test 3:** Tests on Channel Fixed on Beam/Floor

A length of main support channel section shall be fixed to steel structure/floor and have loads applied as detailed below and other important points not mentioned herein.

- c) Test 3A** A length of steel structure shall be rigidly supported it should be fitted on a metre length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place.

- d) Test 3B** With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place.

- e) Test 3C** With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line. The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

d) Test 4 Channel nut slip characteristics (what ever applicable)

Tests 4A1, 4A2, 4A3:

A length of channel C1 section 200 mm long shall have fitted bracket with the two bolts fixing. With loads applied at the appropriate position nut slip shall be determined with bolt torque of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting. A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM.

Tests 4B1, 4B2, 4B3:

The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing. With loads applied at the appropriate position, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting. A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 6 NM

Test 5 Weld Integrity Test

After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any. Cable termination kit and straight through joints should have been tested as per IS: 13573 for 6.6kV and 11kV class. Fire proof Cable Penetration system should have been tested for the following tests:

- a) Accelerated Ageing test
- b) Water absorption test
- c) Fire rating test
- d) Hose Stream test
- e) Vibration test followed by fire rating test

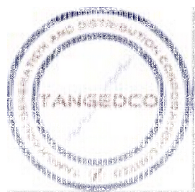
2 Routine/ Acceptance Tests

Following routine/acceptance tests shall be carried out on all the equipments, devices & materials supplied:

a) Galvanizing Tests

The quality of galvanizing shall be inspected visually and shall be smooth, continuous, and free from flux stains.

- i) Uniformity of coating – The coating of any article shall withstand four 1 minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- ii) The quality of cadmium/zinc plating on items with screw threads shall be inspected visually and shall be free from visible defects such as unplated areas, blisters and modules.
- iii) In addition, the plating thickness shall be determined microscopically/chemically or electronically.

3 Welding

The quality of welding shall be visually inspected, particular attention being paid to the following points.

- 1) The welded joints shall be continuous along its length on both sides and of uniform width and thickness. It should be free from blow holes.
- 2) The weld metal shall be properly fused with the parent metal without undercutting.
- 3) The outside surface of the weld shall be clean. All slag shall have been removed. All welding shall be regularly checked for cracking using magnetic particle inspection or their equivalent technique.
 1. Physical and dimensional checks for all items.
 2. All conduits/pipes, etc. shall be routine/acceptance tested as per relevant standards.
 3. All acceptance and routine tests on cable glands as for BS: 6121. Additionally Proof torque test shall be carried out as acceptance on each body group of cable glands.
 4. Deflection test cable trays.
 5. All acceptance and routine tests on Junction boxes.
 6. Following tests shall also be carried out on each type of equipments, devices and materials/items supplied:
 - 1) Physical and Dimensional checks
 - 2) Check/measurement of thickness for Nickel chrome plating for cable glands and tinning for cable lugs.
 - 3) Check chemical composition of brass parts for cable glands.
 - 4) Hardness check on gaskets.
 - 5) Test for uniformity of galvanization.

4 Cable trays / supports and accessories

- 1) Check for proper galvanizing/painting and identification number of the cable trays/supports and accessories.
- 2) Check for continuity of cable trays over the entire route.
- 3) Check that all sharp corners, burrs, and waste materials have been removed from the trays supports.
- 4) Check for earth continuity

Earthing and Lightning Protection System



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.18 EARTHING AND LIGHTNING PROTECTION SYSTEM

2.2.18.1 Earthing System

2.2.18.2 Scope

- ii. The Contractor shall provide all required material and carry out main earth grid, treated earth pits, raisers and inter connections, equipment earthing, interconnection to the existing, BOP area earth mats etc. for the following areas and all areas/buildings/structures including but not limited to:
 - a) Main Plant Building (TG Building)
 - b) Boiler Area, ESP area, Circulating water system, DG room & other electrical systems.
 - c) Service building
 - d) Air washer room
 - e) Transformer yard
 - f) All other miscellaneous building not mentioned herein but in BTG supplier scope.
- iii. Earthing system shall consist of earth grids and electrodes buried in soil in the plant area, embedded in concrete inside the buildings to which all the electrical equipment, metallic structures are connected to have earth continuity for safety reasons. The earthing system shall conform to IS 3043 and Indian Electricity Act/rules.
- iv. The Contractor shall furnish the detailed design, layout and calculations for Owner's approval. Contractor shall obtain all necessary statutory approvals for the system.

2.2.18.3 Codes and Standards

- i. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards / codes as applicable.
- ii. Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed below. In such a case, the Contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**

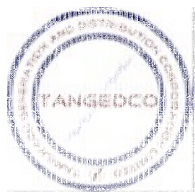


EPC TENDER SPECIFICATION FOR BTG PACKAGE

- | | | |
|-----|---------------------------|---|
| 1. | IS:513 | - Cold rolled low carbon steel sheets and strips |
| 2. | IS:802 | - Code of practice for the use of Structural Steel in Overhead Transmission Line Towers |
| 3. | IS:1079 | - Hot Rolled carbon steel sheet & strips |
| 4. | IS:1239 | - Mild steel tubes, tubular and other wrought steel fittings |
| 5. | IS:1367 Part-13 | - Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners) |
| 6. | IS:2309 | - Code of Practice for the protection of building and allied structures against lightning |
| 7. | IS:2629 | - Recommended practice for hot dip galvanising of iron & steel |
| 8. | IS:2633 | - Method for testing uniformity of coating on zinc coated articles |
| 9. | IS:3043 | - Code of practice for Earthing |
| 10. | IS:6745 | - Methods for determination of mass of zinc coating on zinc coated iron & steel articles |
| 11. | IS:9595 | - Metal – arc welding of carbon and carbon manganese steels – recommendations |
| 12. | IEEE:80 | - IEEE guide for safety in AC substation grounding |
| 13. | IEEE:142 | - Grounding of Industrial & commercial power systems |
| 14. | Indian Electricity Act. | |
| 15. | Indian Electricity Rules. | |

2.2.18.4 Design Criteria

1. Fault Current & Duration



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Earthing system network/earth mat shall be interconnected mesh of mild steel rods buried in ground in the plant. For earth mat design, the size of earthing conductor shall be calculated considering maximum fault current 50 kA for duration of 1 second and corrosion factor. The maximum permissible step and touch potentials shall be calculated in accordance with the formula, given in IEEE-80.

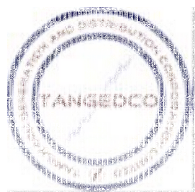
2. Conductor Material

- i. The earthing system conductors and accessories as proposed are to be as:
 - (a) Conductors above ground level and in trenches : Galvanized steel
 - (b) Conductors buried in ground or embedded in concrete : Mild Steel
 - (c) Electrodes : GS Pipe / Rod
- ii. The contractor shall undertake the soil resistivity measurements at site and shall select suitable type of conductors.
- iii. The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects.

3. Size of Conductors

The minimum sizes of earthing conductors for various electrical equipments shall be as below:

Sl.No	Equipment	Earth Conductor buried in earth	Earth conductor above ground level & in built up trenches
1.	Main earth Grid	40 mm dia. MS Rod	---
2.	Transformeryard	40 mm dia. MS Rod	---
3.	Switchyard	40 mm dia. MS Rod	---
4.	Power Transformer		75 x 10 mm GS Flat
5.	11kV / 6.6 kV / 415 V Switchgear / Equipment	---	75 x 10 mm GS Flat
6.	415 V MCC / Distribution Boards/ Distribuiton Transformers	---	75 x 10 mm GS flat
7.	LV motors		
	Above 100 to 200 kW	---	75x10 mm GS flat
	Above 55 KW to 100 KW	---	50x6 mm GS flat



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

	Above 22 KW to 55 KW	---	50x6 mm GS flat
	Above 5.5 KW to 22 KW	---	25x6 mm GS flat
	Fractional HP LV Motors	---	8 SWG GS Wire
8.	Control panel & Control Desk	---	50x6 mm GS flat
9.	Push Button Station / Junction Boxes	---	8 SWG GI Wire
10.	Column, Structures, Cable tray, fence , gate and busduct enclosures	---	50x6 mm GS flat
11.	Crane, Rail, Rail tracks & other non-current carrying metal parts	---	50x6 mm GS flat

4. Soil Treatment to lower Resistivity

The soil resistivity study shall be carried out by the contractor. In order to reduce the resistivity of the soil the earth pits shall be treated with high purity electrically conductive material having ultra-low resistance value (typically, 0.001 ohm-m). The properties of the material shall be such that it does not require periodic re-watering or recharge of salt or earth enhancing compound during the life of the power plant. The material should be such that it does not reach chemicals into the adjacent soil or underground water channels and should be PH neutral. Earth enhancing material should permanently protect the encased metal components of the earthing systems. Earthing electrodes encased in high strength concrete mixed with the conductive material shall be preferred instead of electrode buried directly in the earth.

5. Rod Electrodes

Galvanized steel pipe/rod electrodes of suitable diameter and length shall be used as per the recommendation of IS-3043. For test pits electrodes shall be heavy duty type (Class – C) GI pipe of suitable diameter with perforations. For treated earth pits, GI pipe shall be provided as per IS 3043 including charcoal, salt etc. Necessary number of treated earth pits shall be provided for UTs, UATs in the transformer yard and other UATs in the main power house building and for all LT transformer Neutral & body earthing. Electrodes installed in the test pits will have disconnecting facilities.

6. Earthing of Electrical equipment on cranes and travelling machines



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- i. Every electrical equipment shall have double earthing. A ring earthing system shall be provided within the crane/machine to which electrical equipment shall be connected at least at two places.
- ii. The earth ring on the crane/machine shall be connected to the plant earthing system through gantry rails. Two sets of earth collector brushes shall be provided on each side of crane/machine to connect its earth ring to the gantry rails. Each end of each gantry rail shall be bonded to the plant earthing system.
- iii. In addition, intermediate earthing bond shall also be provided on the rails at every 60 m in case of longer tracks. Flexible copper bonds shall be provided across any gap in the running gantry rails. For mobile equipment with flexible cables, one separate copper conductor of adequate size shall be provided for earthing.

7. Equipment Earthing Leads

The size of the earthing leads shall be decided based on the type of equipment and structure to be earthed and shall be provided generally as per IS-3043.

2.2.18.5 Earthing System Layout

1. General

- i. Metallic frames of all current carrying equipment, supporting structures adjacent to current carrying conductors, structures in contact with switchyard earth, lightning protection system conductors and neutral points of various systems shall be connected to a single earthing system.
- ii. All the offsite areas shall be interconnected together by minimum two parallel conductors.
- iii. Crane rails, tracks, metal pipes and conduits shall be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing lead ensured by bonding the different sections of hand rails and metallic stairs.
- iv. For all other equipments, two earthing leads shall be used if rated voltage of equipment is above 250V. In case the rated voltage is 250 V or below, one earth lead can be used. Metallic structures adjacent to electrical equipment shall be earthed by one earthing lead.
- v. Earthing conductors in outdoor areas shall be installed at a minimum depth of 600 mm.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi. Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 metre. Wherever earth mat is not available Contractor shall do the necessary connections by driving an earth electrode in the ground.
- vii. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable .
- viii. The cable sheaths, screens armour shall be earthed at both ends for multi-core cables. For single core cables the same shall be done at one end (switchgear end) only.
- ix. Electronic earthing shall be provided as per relevant international standard for all control systems (such as DDCMIS,PLC,SAS,EDMS,etc.,). For electronic equipment chemical earthing pit shall be provided. The earth pit shall be tested and type proven and shall be guaranteed for service life of 40 years. The chemical earth pit shall comprise pipe electrode,crystalline conductive mixture, bentonite, etc., constructed in a pit of not less than 4000mm depth. The pit shall be effective in all weather conditions and offer medium resistance. For electronic earthing system, earthing conductor shall be copper.
- x. Neutral of Service transformers shall be earthed through minimum of 400 sq.mm single core cable through two numbers treated earth pit and return shall be connected to station earth grid.
- xi. LV Neutral points of the following transformers shall be connected to Neutral Grounding Resistors(NGR). NGR shall be connected to earth through two numbers treated earth pit.
 - a) Unit transformers
 - b) Station Transformer
 - c) Unit , station and other Auxiliary transformers
- xii. Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingress.
- xiii. Metallic sheaths and armour of all multi-core power cables shall be earthed at both equipment and switchgear end, Sheath and armour of single core power cables shall be earthed at switchgear end only.
- xiv. Earthing conductors along their run on cable trench, ladder, walls etc., shall be supported by suitable welding/cleating at intervals of 1000mm. Wherever it passes through walls, floors etc., pipe sleeves shall be provided for the passage of the conductor and both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xv. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid at several locations.
- xvi. Electronic panels and equipments shall be grounded utilizing an insulated copper ground wire terminated at separate earth electrodes.

2. Earthing Conductor layout

- i. Main earthing conductors shall be laid in the form of a grid. Spacing between conductors, number of parallel conductors, etc., shall be decided such that step and touch potential are within safe limits.
- ii. The maximum permissible step and touch potentials shall be calculated in accordance with the formula, given in IEEE-80.
- iii. Earthing conductors shall be provided around the outside edge of fence at a distance of approximately 6000 mm. This shall be connected to the main earthing grid.
- iv. Grounding conductor around the building shall be buried in earth at a minimum distance of 1200 mm from the outer boundary of the building.
 - i. Every alternate post of the fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post.
 - ii. Each of the earth leads of transformer neutral, lightning arrester shall be directly connected to two separate electrodes. Neutral points of HV transformer shall be earthed through NG resistors. The Contractor shall connect the NGR earthing point to earth electrodes by suitable earth conductors. Lightning protection down conductor shall be directly connected to a separate earth electrode.
 - iii. All earth electrodes in turn shall be connected to main earthing system. The earth grids of different areas of the plant shall be interconnected through, test pits to enable measurement of earth resistance for each area separately.
 - iv. Earthing grid design shall be done in such a manner that the grid resistance is less than one ohm.
 - v. Earth pit shall be constructed as per IS: 3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be atleast equivalent to twice the length of the electrode.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

3. Earthing Conductors inside the building

- i. Main earthing conductors shall be buried in earth around the building. Minimum two taps-off from this earthing loop shall be taken inside the building and connected to the earthing grid embedded in the floor slab with approximately 50 mm concrete cover. The requirement of electrodes around the building shall be specified.
- ii. In case the building has more than one floor, each floor shall be provided with separate earth grid. These floor earthing grids shall be interconnected.
- iii. Each RCC / Steel column of the building shall be interconnected to the floor earthing grid in the ground floor.
- iv. Instrumentation system and computer system shall be provided with a dedicated earthing system suitable for the equipment. Separate electronic earthing for the PLC equipments, SAS panels and all other equipments wherever necessary shall also be provided.
- v. Earthing grids of all the buildings, outdoor yards shall be interconnected to form a single grid for the plant.
- vi. Earthing grid design shall be done in such a manner that the grid resistance is less than one ohm.
- vii. Suitable earth risers as approved by Owner shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.
- viii. A minimum earth coverage of 300 mm shall be provided between the ground grid conductor and the bottom of trenches, tunnels, underground pipes, foundations, railway tracks etc. The ground grid conductor shall be re-routed in case it fouls with equipment foundations.

2.2.18.6 Earthing System Installation

- i. The spacing between two electrodes shall be at least equivalent to twice the length of the electrode.
- ii. Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively. 8 SWG earth wire should be run along with lighting conduits and shall be earthed at both ends. The wire should be suitable clamped with conduit at equal interval at not more than 500 mm.

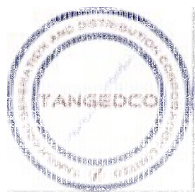


**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. The earthing conductor crossing the road / track shall be laid in hume pipe or laid at a greater depth to avoid damage.
- iv. When earth conductor passes through floors, walls, etc., suitable pipe sleeves shall be provided and the same shall be sealed after installation.
- v. The connection between earthing pads / terminal to the earth grid shall be made short and direct and shall be free from kinks & splices.
- vi. Cable trays, metal pipes / conduits, steel columns, etc., shall not be used as earth continuity conductors.
- vii. Street lighting poles, flood light poles & towers, their junction boxes shall be connected to the earthing conductor to be run along with supply cable. This earth conductor shall be in turn connected to earth grid at two extreme points.
- viii. Flexible earth conductors shall be provided at expansion joints for earthing the gates, operating handles, etc.
- ix. Equipment bolted connection after being checked and tested shall be painted with anti-corrosive paint / compound be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.
- x. Proper earth connections for cable glands, cable boxes, cable armour, screens, etc. to be provided.
- xi. All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- xii. The contractor shall demonstrate the effectiveness of earthing system by measurement of earth resistance, step and touch potential at different locations. Earth resistance at earth terminations shall be measured in presence of Owner's representatives. All equipment required for testing shall be furnished by contractor.
- xiii. Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.
- xiv. Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. The overlapping of earthing conductor in welded joints should be 6 times diameter. Cleats should be



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

provided at both sides to increase contact area. Angles/ cleats should be welded at the point of crossing of longitudinal and transverse earthing conductors.

- xv. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.
- xvi. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. Trenches after laying earth rods should be closed with approved filling materials in layers and not with debris.

2.2.18.7 Other Requirements of Earthing System

Life expectancy	40 years
System Fault level	50kA for one second
Minimum Steel corrosion	0.3mm/year (on dia. of conductor)
Depth of burial of main earth conductor	600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.
Conductor joints	By electric arc welding, with resistance of joint not more than that of the conductor.

2.2.18.8 Lightning Protection System

- i. The main purpose of lightning protection system are to :
 - Provide protection to structures from lightning strokes.
 - Provide a low resistance-conductive path to lightning discharge.
- ii. Lightning protection system shall be in strict accordance with IS: 2309 for the structures, equipments and buildings within the battery limits.

2.2.18.9 Conductor material

For Lightning protection, material & minimum sizes shall be as follows:

- a. Vertical air termination : 20 mm dia MS rod
- b. Horizontal air termination : 25X6 mm Galvanised steel flats
- c. Down conductor : 25X6 mm Galvanised steel flats
- d. Test link : 150x50x6 mm Galvanised steel Strip with Box
- e. Earth Electrodes : Treated earth pit with pipe electrode as per IS:3043



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

The above sizes are indicative only. Actual size shall be arrived at as per design by the Bidder.

2.2.18.10 Lightning Syatem Layout

- i. Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc.
- ii. Air termination network consisting of vertical or horizontal conductors or combination of both shall be provided for the building. Down conductors shall follow the most direct path possible between the air terminal network and the earth termination network. Each down conductor shall be provided with a test link for testing. An earth electrode shall be connected to each down conductor.
- iii. Suitable lightning protection shall be provided to protect
 - a) Main Power House building as per IS requirement
 - b) Boiler Area, ESP area, DG room, Service building & other electrical systems.
 - c) All other miscellaneous building & electrical systems not mentioned herein but in scope of main plant (BTG) supplier.
- iv. Installation of lightning conductors on the roofs of buildings shall include construction of support, laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods wherever necessary, laying, fastening / cleating / welding of the down comers on the walls / columns of the building and connection to the test links to be provided above ground level.

2.2.18.11 Air Terminations

- i. The vertical air terminal rods shall be installed at the roof of buildings for MCC/Switchgear rooms, ESP Control rooms etc to protect these objects from lightning strokes.
- ii. ii) The projected length of the Air termination rod shall be as required to protect the object (on which the rod is fixed) from lightning stroke.
- iii. The air terminal rod shall be properly fixed on the top of the building/structure to withstand very high wind pressure. In case the air terminal rod is embedded at the top of roof of building, the portion embedded inside the concrete shall not touch the reinforcement bars and shall be duly insulated from them.
- iv. All the vertical air terminal rods shall be electrically connected together by means of horizontal conductors of size 25 x 6 mm galvanized steel flats. Horizontal air



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

termination (i.e. G.S. Flat conductor) shall be so laid that no part of the rod shall be more than nine (9) metres from the nearest roof conductor.

2.2.18.12 Shielding Masts

- v. The shielding mast for lightning protection shall be installed at the top of steel columns cap plates of the associated building.
- vi. The shielding mast shall be made of galvanized steel rod and the height of the same shall be decided considering the zones to be protected.
- vii. Each shielding mast shall be connected to grounding grid by a down conductor 50 x 6 mm minimum. Galvanised steel flat run along the building column. In addition all building columns joints shall be electrically bonded.

2.2.18.13 Down conductors

- i. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.
- ii. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.
- iii. All joints in the down conductors shall be welded type.
- iv. Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.
- v. Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.
- vi. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.
- vii. Lightning conductors shall not pass through or run inside GI Conduits.
- viii. Testing link shall be made of galvanized steel of size 25x 6mm.
- ix. Pulser system for lightning shall not be accepted.
- x. Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- x. Lightning protection conductors/ air termination rods and circumferential band provided at the top position of chimney stack shall be lead coated in order to avoid melting by exposure to hot flue gases.
- xii. For tall buildings and structures, early streamer emission (ESE) type, air terminal system is preferred.
- xiii. Horizontal air termination flats provided on top of boilers, main plant building & other buildings shall be laid such that no part of the roof shall be more than 9 metres.
- xiv. Conductors of lightning protection system shall not be connected with conductors of earthing system above ground level.
- xv. Lightning protection shall have as few joint as possible and avoid sharp bends. Down conductors shall have as far as possible, no joint except at test point and end termination.
- xvi. Termination at the metallic equipments on roof should be made by suitable nuts, bolts, pressure washer and bitumen washers with good electrical conductivity.
- xvii. All lightning protection conductors shall be exposed to atmosphere unless specifically mentioned. The lightning protection in the transformeryard shall cover the following equipments in the protection zone.
 - a) Generator Transformer
 - b) Station Transformer
 - c) Unit Transformers
 - d) Auxiliary Transformers
- xviii. All areas of the power station shall be provided with lightning protection. The lightning protection system for buildings shall consist of Air termination network, Down conductors, Test link and earth electrodes.
- xix. Air termination network consisting of vertical or horizontal conductors or combination of both shall be provided ofr the building. Down conductors shall follow the most direct path possible between the air terminal network and the earth termination network. Each down conductor shall be provided with a test link for testing. An earth electrode shall be connected to each down conductor.
- xx. For lightning protection , material thickness of galvanizing shall be atleast 610 gm / sq.mm for all galvanised steel conductor.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xxi. The lightning protection system shall not come in direct contact with other equipment / systems such as cables, conduits, electrical equipment, under ground metallic ducts etc., All metallic structures within vicinity shall be bonded to the lightning protection system.
- xxii. All welded / brazed joints shall be coated with anti-corrosive paints for rust protection.
- xxiii. Lightning conductor when used above ground level and shall be connected through test link with earth electrode / earthing system. Down conductors shall be as short and straight as practical and shall follow a direct path to earth. Down conductor shall not be connected to other earthing conductors above ground level.
- xxiv. Each down conductor shall be provided with attest link at 1500 mm above ground level for testing. But it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point. All joints in the down conductors shall be welded type.
- xxv. Down conductors shall be cleated on outer side of the building wall / welded to outside building columns at 750 mm interval.
- xxvi. Lightning conductor on the roof shall be cleated on surface of roof using insulated clamps / saddles for conductor fixing at an interval of 1000 mm for horizontal run and 750 mm for vertical run.
- xxvii. Conductor of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.
- xxviii. Installation of lightning conductors on the roofs of the buildings shall include construction of supports, laying, anchoring, fastening and cleating of horizontal conductors, grounding of vertical rods wherever necessary, laying, fastening / cleating / welding of the down comers on the walls / columns of the buildings and the connections to the test links to be provided above ground level.

2.2.18.14 Electrodes (for Lightning Protection)

- i. The electrodes shall be 40 mm diameter 3000 mm long mild steel rod. These shall be driven into the ground.
- ii. All the electrodes shall be interconnected by means of one (1) 40 mm dia mild steel rod which shall be laid under ground at a minimum depth of 1000 mm below finished grade level unless stated otherwise. This ground mats/electrode in turn shall be connected to main grounding grid.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.18.15 Riser (for Lightning Protection)

All risers connected to grounding mat shall be 40 mm mild steel rods and shall be projected 300 mm above grade level unless stated otherwise.

2.2.18.16 Jointing & Connection

- i. All ground conductor connections below ground level shall be done by electric arc welding with low hydrogen content electrode.
- ii. The projected portion of riser above ground shall be coated with two (2) coats of bitumen paints (anti-corrosive paints) with a minimum thickness of 1 mm after connection.
- iii. The joints in the lightning conductors shall be kept to a minimum and there shall be no joint in the underground portions of conductors.
- iv. All the joints shall be done by arc welding process overlapping of the conductors at straight joints shall not be less than 150 mm. The contact surfaces shall be cleaned properly before jointing.
- v. The portion of galvanized steel flats, which undergoes welding at site, shall be coated with two (2) coats of cold galvanizing anti-corrosive paint after welding.
- vi. The bolted joint of the test link shall be covered with thick coating of bitumen paint after successful testing.
- vii. The air terminal rods and shielding mast shall be coated with weather resistant anti-corrosive paint (zinc chromate followed by two coats of aluminium paint).
- viii. The steel to copper connection shall be brazed type.
- ix. The lightning protection of inflammable liquid storage tanks wherever required, shall be provided with horizontal conductors strung between tall poles covering the entire zones or with air terminal rods mounted on top of poles/structure. These horizontal conductors/vertical air terminal rods shall be connected to rod electrodes, which in turn shall be connected to station ground mat.

2.2.18.17 Quality Assurance Program

Contractor shall furnish detailed Quality Assurance Programme and Quality Plans for all



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

materials and accessories to be supplied and installed under the scope of the specification. The Quality Plans shall include all tests/ checks as per relevant National/International Standards and the requirements of this specification including tests listed in this section.

2.2.18.18 Inspection and Testing

1. Earth Continuity Checks.
2. Earth resistance of the complete system as well as sub system
3. The earthing and lightning conductors should be type tested as per IS 2669. Following minimum tests shall be conducted.
 - a) Freedom from defects
 - b) Uniformity in thickness
 - c) Mass pf coating
 - d) Adhesion tests
 - e) Any other applicable tests not mentioned in the specification but required.

2.2.18.19 Drawing and Documents

The following drawings and documents shall be submitted for approval during detail engineering stage.

1. Soil resistivity report
2. Design basis report for earthing and lightning protection system
3. Earthing design calculation
4. Typical installation drawings for earthing and lightning protection system
5. Electronic earthing layout and details
6. Earthing layout for Transformer yard
7. Earthing layout for power house building, boiler and ESP.
8. Earthing layout for all auxiliary plant buildings
9. Earthing layout for all non-plant buildings
10. Lightning Protection design calculation and layout



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.11 LT SWITCHGEAR

2.2.11.1 CODES AND STANDARDS

All equipment and materials shall be designed, manufactured and tested in accordance with the latest editions including all applicable official amendments of relevant Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

Equipment and material conforming to any other standards, which ensure equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

All works shall be carried out as per the following codes and standards.

Sl.No	Code	Description
1	IEC-60947 IEC-60439 IS-13947	Low voltage switchgear and control gear assemblies.
2	IS-8623	Specification for Low-Voltage Switchgear and Control gear Assemblies
3	IEC-60664 IS-15382	Insulation coordination for equipment with low voltage systems
4	IEC-60044	Instrument transformers
5	IEC-60529	Degrees of protection provided by enclosures
6	IS-13118	High Voltage alternating circuit breakers
7	IS-2675	Enclosed distribution fuse boards and cut outs for voltages not exceeding 1000 V AC and 1200 V DC
8	IS-8828	Electrical Accessories – Circuit breaker for over current Protection
9	IS -12021	Specification for Control transformer for switchgear and control gear for voltages not exceeding 1000V AC
10	IS-5082	Wrought aluminium & aluminium alloy for electrical Purposes
11	IS-13703	Specification for low voltage fuses for voltages not exceeding 1000 V AC and 1500 V



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**

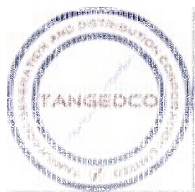


EPC TENDER SPECIFICATION FOR BTG PACKAGE

		DC
12	IS-8187	Specification for D Type fuses
13	IS- 6005	Code of practice for phosphating iron and steel
14	IS-694	694 PVC insulated cables for working voltages up to and including 1100
15	IS-722	AC Electricity Meters
16	IS-1248	Electrical Indicating instruments
17	IS-2551	Danger Notice Plates
18	IS-2629	Hot dip galvanizing
19	IS-2705	Current Transformers
20	IS-3043	Code of practice for earthing
21	IS-3072	Code of practice for installation and maintenance of Switchgear
22	IS-3156	Voltage Transformers
23	IS-3202	Code of practice for climate proofing of electrical equipment
24	IS-3231	Electrical relays for power system protection
25	IS-8686	Static Relays
26	IS-10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear
27	IS-11171	Specification for dry type transformers
28	IS-11353	Guide for uniform system of marking and identification of conductors and apparatus terminals

2.2.11.3.1 TYPE

Circuit Breakers	Shall be air break, three pole, spring charged, and horizontal
Switchgear	Fully draw out type single front



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

MCC	Fully draw out type single front/Double front.
ACDB/DCDB	Fixed type single front

2.2.11.3.2 SYSTEM PARAMETERS

1)	Nominal system voltage	415 V AC	220 V DC
2)	Highest system Voltage	433 V	240 V DC
3)	Voltage variation	±10%	190 - 240
4)	Rated frequency	50 HZ	-
5)	Frequency variation	+3% to (-5%)	-
6)	One minute Power	2.5 kV	2.5 kV
	frequency withstand voltage Main circuit Auxiliary Circuit	2.0 KV	2.0 KV
7)	System Earthing	Solidly Grounded	Unearthed
8)	Maximum system fault level	50KA for 1sec	25KA for 1 sec

2.2.11.3.3 General Technical Requirements

Power from LV service transformers shall be supplied to 415 V switchgears. Power from 415 switchgears to the various MCCs, PDBs, ACDBs etc. shall be supplied from redundant incomers. These switchgears shall distribute power to LV auxiliary motors and also to other auxiliary loads viz. MCCs / ACDBs, etc. LV switchgears shall be of metal enclosed indoor type. Incomers / bus-couplers, outgoing tie feeders rated 630A & above and motor feeders rated 90 kW & above shall be equipped with air circuit breakers of fault interrupting capacity of 50 KA rms.

All PCC/PMCC/MCC shall be of intelligent type compatible with IEC-61850 communication protocol. Utility MCCs like service building MCC, Welding DBs, AC & Ventilation MCCs, etc., shall be non-intelligent type.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All the boards shall be sectionalized, except for turbine valve DB.

Not more than 2 out of 3 ACBs can be closed at a time unless at the time of planned short time paralleling through synchro check.

Under normal mode of operation each incoming source shall be connected to the respective bus sections with bus coupler open.

During the normal mode of operation if there is a loss of normal source to any bus-section, slow bus auto changeover shall be initiated to first trip the normal incomer connected to this section and further close the bus coupler to extend power from healthy bus section.

Restoration of normal operating condition (described in 1.14.6 above) shall be through planned manual changeover through synchro check paralleling or manual dead bus closing.

Incase parallel running between two sources prolong over a set time, an alarm shall be generated and the last ACB to close shall be opened.

The AC control supply voltage for motors rated below 90 kW shall be 110V AC. For this purpose each motor feeder of PMCC/MCC shall be provided with suitable rated 415/110V Control Transformer. Separate control transformer for test bus supply shall be provided for each bus section.

All circuit breakers shall have 220V DC control.

2.2.11.3.4 List of minimum required LV switchgears

S.No	N a m e of LV Switchboard
1.	UNIT PMCC
2.	BUNKER FLOOR MCC
3.	UNIT MLDB
4.	VENTILATION MCC
5.	AC MCC
6.	BOILER MCC
7.	SOOT BLOWER MCC
8.	BOILER VALVE DAMPER MCC
9.	MILL SYSTEM MCC



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

10. TURBINE AUX. MCC
11. TURBINE VALVE DB
12. BOILER ACDB
13. ESP # 1A PMCC
14. ESP # 1B PMCC
15. ESP # 1C PMCC
16. ESP # 1D PMCC
17. ESP # 1E PMCC
18. ESP # 1F PMCC
19. ESP ACDB
20. ESP AC & VENTILATION MCC
21. ESP MLDB
22. DG SWGR AMF PANEL
23. UNIT NORMAL CUM EMERGENCY PMCC
24. 415 V AC ELDB
25. 415 V AC TG Building
26. FUEL OIL UNLOADING PH PMCC
27. SERVICE BUILDING MCC
28. AIR WASHER MCC
29. WELDING PDBs
30. AC AND VENTILATION MCC
31. CPU REGENERATION MCC
32. Main Lighting Distribution Boards (MLDB)
33. Emergency Main Lighting Distribution Board (EMLDB)
34. DC Lighting Distribution Board (DCLDB)
35. AC Fuse Boards

Any other PCC/PMCC/MCC/DB required as per the geographical distribution of load and for any other system which is part of mechanical system under BTG package and required for safe and reliable functioning of the plant.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.11.2 TEMPERATURE RISE

The temperature rise of the horizontal and vertical busbars and main bus link including all the power drawout contracts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg c with silver plated joints and 40 deg c with all other types of joints over an ambient of 50 deg c.

2.2.11.3 OPERATIONAL REQUIREMENTS

2.2.11.3.1 Breakers

- I. Breakers shall have anti-pumping feature and it shall be electrically drawout type. The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.
- II. Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energisation of lockout relay. All breakers Shall have built in interlocks for equipment and personnel safety
- III. Paralleling of two supplies shall be avoided by except for switchgear where auto-changeover is provided. Breaker contact multiplication, if required, shall be through latch relay.
- IV. Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
- V. Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds. It shall be possible to close the door with breaker in test position.
- VI. Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
- VII. Supervision relay shall be provided for trip coil monitoring

2.2.11.3.2 Switches, Contactors and Fuses

- a. Incomers for MCCs and DBs rated up to 630A could be MCCB's & for above ratings ACB are preferred.
- b. Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilisation category.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c. Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element. Visible indication shall be provided on blowing of the fuse.
- d. Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.
- e. Isolating switches and MCCBs shall have door interlocks and padlocking facility.
- f. Wherever two incoming switches and one bus-section switch/breaker are provided for an assembly, these shall be electrically interlocked to ensure that only two out of the three can be closed at time.
- g. Wherever two incoming switches are provided for an assembly, these shall be electrically interlocked to ensure that one of the two can be closed at time.

2.2.11.3.3 Panels

- a. All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.
- b. Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall be of DOP IP55. Push buttons shall be of latch type with mushroom knobs.
- c. Where breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.
- d. All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
- e. Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- f. The incoming connection to transformer of more than 1000KVA and inter-connecting Sections between switchboards shall preferably be of bus ducts. The bus duct enclosure shall be made of minimum 3mm thick aluminium alloy. The section of the bus duct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor bus duct enclosure joints to provide additional protection against water ingress. The bus duct top shall be sloped to prevent retention of water. The bus duct shall have DOP of IP55.
- g. It should be possible to carryout maintenance on a feeder with adjacent feeders alive

2.2.11.3.4 Control, Protection & Metering Requirements

- i) Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC. The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.
- ii) Contractor shall fully co-ordinate overload and short circuit tripping of breaker with upstream and downstream breakers/fuses/MCCBs motor starters. Various equipment's shall meet requirement of Type-II class of coordination as per IEC.
- iii) All relays and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.
- iv) All equipment's shall have necessary protections. However, following minimum protections shall be provided:

MPCB with Contactor controlled LV motor feeders (Motors rated 18.5kW & below) having intelligent controller
 - a. Instantaneous short circuit protection
 - b. Overload protection
- v) MCCB with Contactor controlled LV motor feeders (Motors rated above 18.5kW but below 90 kW) having intelligent controller
 - a. Instantaneous short circuit protection



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- b. Overload protection
- vi) Single phasing protection for motors rated 30 kW and above rating
- vii) In Instantaneous short circuit protection on all phases through HRC cartridge type fuses / MCCB rated for 80 kA rms (prospective breaking capacity at 415V).
- viii) Thermal overload protection
- ix) Single phasing protection for motors protected by fuses.
- x) Breaker controlled motors feeders (motors rated above 90kW) Numerical, comprehensive motor protection relay with following minimum facility as indicated below :
 - a. Instantaneous short circuit protection
 - b. Overload protection
 - c. Under voltage protection
 - d. Locked Rotor protection
 - e. Earth fault protection
 - f. Current unbalance.
 - g. Temperature monitoring (stator, bearing etc.).
 - h. Phase reversal.
 - i. Thermal model based with RTD feedback and negative sequence current.
 - j. Voltage compensated acceleration.
- xi) Incomers (ACB):
 - a. 3 ph IDMT Overcurrent & earth fault protection (51,51N)
 - b. 3 ph Instantaneous Overcurrent protection (50)



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- c. Standby earth fault protection for service transformer protection (connected on transformer neutral CT side)
 - d. Under voltage protection (27) with Timer & Fuse failure protection
 - e. Neutral dEviation relay
- xii) Buscoupler (ACB):
 - a. 3ph IDMT Overcurrent & earth fault protection (51 & 51N)
 - b. Sync check relay (25)
- xiii) Bus PT:
 - a. Under voltage protection (27)
 - b. No voltage protection (27)
 - c. Fuse failure protection (97)
- xiv) ACB outgoing feeders:
 - 3 ph IDMT Overcurrent protection (51, 51N)
- xv) Incomer from DG Set.
 - a) Differential Protection (87) - Three Pole
 - b) Reverse Power Protection.
 - c) Overload Alarm on one phase
 - d) Earth Fault Detection Relay (64)
 - e) Voltage controlled Overcurrent relay
 - f) Generator under/over voltage Protection
 - g) Hand Reset/Lockout Relay with a blue lamp.
 - h) 3 Phase Energy Meter having accuracy of 1.0 class



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Apart from protection relays, each electrically operated breaker shall also be provided with Anti pumping (94), trip annunciation(30), lockout (86). Lockout supervision (95) and trip supervision (74) relays. Lockout relay shall be hand reset type.

2.2.11.3.5 Meters / instruments

- I. All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. Size with 90 degree linear scales and accuracy class of 2.0. All motors above 7.5 kW shall have directly connected ammeter and Motors above 30kW shall have CT connected Ammeter with ASS. Necessary Current transducers shall be provided for the same. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.
- II. All Incoming feeders shall be provided with MFM, Ammeter with selector switches & with necessary kW transducer, Current transducers etc., Bus PT feeder shall be provided with Voltmeter + VSS & necessary Transducers. All Outgoing supply feeders shall be provided with Ammeters + ASS & necessary transducers.
 - a. In case of remote controlled breaker panels, following shall be ensured. Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test position whereas closing from remote shall be possible in either service or test position. Tripping from local shall be possible only when local/remote selector switch is in local position. Tripping from remote shall be either breaker in service position or selector switch being in remote position.
 - b. Control from Remote Necessary hardware shall be provided in the switchgear panel like coupling relays (24V DC, with max. burden of 2.5VA), auxiliary relays, current/voltage transducers (4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.

2.2.11.3.6 DESIGN AND CONSTRUCTIONAL FEATURES

- 1) All 415V switch gear motor control centres (MCCs), AC & DC distribution boards (DBs), etc. shall have following features
- 2) Shall be of metal enclosed, indoor, floor mounted and free standing type.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- 3) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm.
- 4) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.
- 5) All switchboards/panels shall be of dust and vermin proof. All cut-outs shall have synthetic rubber gaskets.
- 6) All switchboards, MCCs and DB s shall have following distinct vertical sections.
 - i) Completely enclosed bus bar compartment for horizontal and vertical busbars.
 - ii) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder).
 - iii) Compartment for cable alley or cable box for power and control cables. In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables.
 - iv) For cable connection to circuit breaker a separately enclosed cable compartment shall also be acceptable.
 - v) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.
 - vi) The switchboards/MCC/DBs of 1600A & above rating shall be of DOP IP42 & of IP52 for less than 1600A rating.
 - vii) All 415V switchgears, MCC's, AC & DC distribution boards etc. shall be painted by powder coating process. Paint shade for complete panels excluding end covers shall be RAL7032 for extreme end covers of all boards.
- 7) Busbars shall be of high conductivity aluminium alloy or copper.
- 8) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

shall be at least 10mm. wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti-tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.

- 9) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti-tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.
- 10) Busbar insulators shall be of track-resistant high strength non-hygro- scopic, non- combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.
- 11) All types of relays and timer shall be subject to Purchaser's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.
- 12) Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS/PLC.
- 13) The switchgears/MCC shall be designed to offer adequate level of safety to operating/ maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Bidder shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room discribing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.
- 14) All current and voltage transformers as required for metering & protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall be completely encapsulated, cast resin insulated type. Incomers from



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

transformers shall have CTs for transformer restricted earth fault protection.
The accuracy shall be as follows:

- 15) Other CT particulars like ratio, burden knee-point voltage, excitation current and secondary resistance shall be decided by the Tenderers
- 16) CT secondary shall be rated for 1 A for metering and either 5 A or 1 A for protection.
- 17) indicating lamps shall be cluster LED type
- 18) 20% spare feeders of each type & rating used in the MCC with a minimum one (1) number on each bus section shall be provided.

2.2.11.3.7 ESSENTIAL SERVICE MODULE

During auto changeover of the supply the contactors in the affected bus would have dropped off. Services, which, shall be restarted immediately without time lapse to keep the unit running, are considered essential services. Such auxiliaries shall restart automatically without any action by the operator after an auto changeover. These modules shall have additional hardware like timer (or time delayed closing from DCS), aux. contactors and associated circuitry in the module. Such essential services shall be identified during the detailed engineering stage and suitable module/scheme shall be provided.

The modules of some of the critical application motors like barring gear motor, air heater motor, lube oil pump, jacking oil pump etc. irrespective of their kW rating shall be provided with a CT, ammeter and a current transducer with remote metering in DCS.

2.2.11.3.8 Type Tests

GENERAL

All equipment's to be supplied shall be of type tested quality. The Contractor shall submit for Purchaser's approval the reports of all the type tests as listed in this specification and carried out within last five years from the zero date of the project. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the zero date of the project, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Purchaser and submit the reports for approval.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The following type test certificates on each type & rating of L.T. Switchgear, MCC panel and distribution boards shall be submitted.

- a. Short time withstand test with circuit breaker mounted inside the switchgear panel.
- b. Temperature rise test.
- c. Type II - Short circuit co-ordination test for any three ratings of MCC module as selected by the Purchaser.
- d. Test sequence –1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel.
- e. Degree of protection tests

2.2.11.3.9 ROUTINE TEST

LT SWITCHGEAR

Switchgear shall be subjected to all routine tests as per relevant standards along with following tests:

Temperature rise test on power circuits

- a. Short time current tests on power circuits.
- b. Mechanical operation test
- c. Insulation resistance and 500V DC Megger before/ after 1 minute HV xvi) test
- d. Electrical control, interlock and sequential operation tests
- e. Verification of wiring as per approved schematic.

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: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB-SECTION - IIC
		REV.NO. 0 DATE :

SECTION – IIC
GENERAL TECHNICAL REQUIREMENT (CONTROL AND
INSTRUMENTATION)

INDEX

S. No.	DESCRIPTION
1.	NOT APPLICABLE
2.	INDEX SHEET
3.	NOT APPLICABLE
4.	FIELD & MEASURING INSTRUMENTS
5.	ERECTION HARDWARE
6.	LOCAL PANEL & DATA SHEET
7.	NOT APPLICABLE
8.	BLOCK INTERFACE DIAGRAM
9.	ACTUATORS
10.	DRIVE CONTROL PHILOSOPHY
11.	INSTRUMENT INSTALLATION DRAWING
12.	NOT APPLICABLE
13.	NOT APPLICABLE

FIELD & MEASURING INSTRUMENTS

|



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

CHAPTER-3

FIELD AND MEASURING INSTRUMENTS

2.3.3 Field & Measuring Instruments (Primary & Secondary Instruments)

2.3.3.1 General requirements

Instruments, control devices and other equipment accessories covered under this specification shall be furnished in accordance with I&C specification sheets and drawings enclosed herewith and the requirements of all applicable clauses of this specification.

The instrumentation and control equipment shall conform to all applicable codes and standards including those referred in Cl. no. 2.3.1.6 in this Volume. All equipment and systems shall also fully comply with the design criteria stated in chapter-2 of this part.

The instrumentation/control equipment and accessories shall be from the latest proven design for which the performance and high availability have been demonstrated by a considerable record of successful operation in power station service for similar applications. The bidder shall furnish sufficient evidence to fully satisfy the Owner in this regard.

For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.

Every instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

Following minimum requirement of field instruments shall be fulfilled by Bidder (In addition, Redundancy criteria for field instruments shall be as specified elsewhere in specification): -



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- a. Level switches / pressure switches / flow switches/any other process switches etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.
- b. Level switches (Type as per Owner approval) for sump/tank level high/normal/ low/very low interlocks.
- c. Level Transmitters (Type as per Owner approval) for open sump/ tank/bunker/vessel/heaters.
- d. Stand pipes on both side of tank for all level instruments (LT, LS & LG).
- e. Flow elements (Type as per Owner approval) with flow transmitter & Flow meter for flow measurement of process medium like Steam, Water, Air, Flue Gas, Fuel oil, open channel liquid, solid fuel, ash flow, DM water, Raw water, Instrument and Service air etc. as decided by owner.
- f. Pressure gauges and temp. Gauges at inlet and outlet of each heat exchanger and cooler.
- g. DPG, DPT & DPS across the filters/strainers.
- h. Tapping points/test points shall be provided.
- i. All primary Instruments, hardwares & JBs etc. used for measurement for HFO, LDO & Turbine Lube Oil system shall be flame proof (IEC-79.1, Part I). All primary Instruments, hardwares & JBs etc. used for measurement for Hydrogen shall be intrinsically safe and explosion proof as per NEC article 500, class 1, Division 1 area I.
- j. All Thermocouples & RTDs (Type as per Owner approval) shall be Duplex. Thermocouples shall be provided for Services with Temperature > 200 deg C.
- k. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).
- l. All primary instruments installed at "Minus level or Floor" shall be with protection class of IP 68.
- m. Transmitters (all type) for monitoring & controls purpose.
- n. Bidder shall provide electronics weighing in motion system as per IS-11547, hermitically sealed load cell of precision strain gauge type, 100% over load protection of cell and 250% overload protection for the construction; one calibrator attachment with two Weigher.
- o. All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- p. All limit switch shall be conform to IEC-60947-5-1 and shall have minimum 2SPDT/DPDT contacts.
- q. At APH, temperature measuring device of different lengths forming grid shall be provided to have average temperature for variable flow of flue gas, secondary air and primary air. These temperatures may be connected to nearest remote I/O panel.
- r. On both left and right sides of furnace, separate lines shall be laid and provided with furnace pressure transmitters having wide range than the furnace pressure transmitters used for modulating control.
- s. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services / application only. However any RTD & Thermocouples are used for control, interlock & protection application, same shall be directly wired to DDCMIS/DCS using instrumentation & Extension cables respectively.
- t. As for the water flow/ steam flow measurements, necessary flow elements/ transmitters are chosen in the process line and supplied such that their algebraic summation shall be mass balanced for calculating the system efficiency.
- u. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorised valves and dampers.
- v. For CW sump level, Turbine oil tank, Ash Silo, LDO/HFO tank, DM water tanks, CS tank, Acid and alkali applications, only noncontact type level transmitters like Acoustic, Ultrasonic, and Radar based (Type as per Owner approval) shall be provided by bidders as specified in Tender Specification and as approved by owner.
- w. ~~For Turbine oil, HFO/LDO applications & H2 Gas application, Zener protection on power supplies shall be included.~~
- x. Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. ~~For HFO, LFO Applications, SS capillary with thin wafer element with ANSI RF flanged ends are to be provided. For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided.~~
- y. ~~Considering the type of application, wireless technology to bring signals to DDCMIS may be adopted by interfacing with OPC gateway to avoid cabling for smart level transmitters specified above at sr. no. xxi, in case used for monitoring only. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner. Wirelss transmitters shall have the same minimum specification/ parameters as mentioned for wired transmitters.~~



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- z. Gauges (all type) for local monitoring in field.
- aa. Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two contacts i.e. 2SPDT OR DPDT.
- bb. All instruments should be supplied with valid calibration and test certificates provided by OEM.
- cc. Canopy/Enclosure shall be provided for field instruments like transmitters, switches & flow meters, etc and any other equipment to protect from direct sun light, lightning & rain.

Field instruments shall be supplied & offered as per data sheets specified below:

2.3.3.2 Transmitters, Switches, Gauges and Panel Mounted Instruments

i) Pressure, Differential Pressure, DP type Level and Flow Transmitters (PT, DPT, LT & FT)

Smart Transmitters of the electronic type shall be furnished. All Transmitter shall be installed in closed LIE in the boiler area. Similarly transmitter for TG shall also be in LIE except the transmitters located in covered area on TG floor and these shall be mounted in LIR. Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures.

In general, Transmitters are envisaged to be grouped at several places as to be decided during detailed engg. Stage. For this purpose, suitable enclosures complete with all tubing, fittings, purge meters, loop cable trays etc. shall be provided.

S.No	Features	Essential / Minimum Requirements
1	Type/Construction	Sealed capacitance/ Inductance/ Silicon resonance type
2	Material	
	Body	Die cast Aluminium with epoxy coating for air & flue gas, SS316 for other services
	Diaphragm	SS316 With Teflon seal for process requirement/process media for other services
	Measurement element	316 SS (Suitable material/coating for Hydrogen pressure transmitters/Differential pressure transmitters) the suitable material/coating shall be chosen as per the suggestion of transmitter manufacturer.
	Valves	Carbon steel for non-corrosive applications & SS316 for corrosive applications
3	Output Signal	4 to 20 m Amp. DC (Two wires) HART Compatible
4	Local Indicator	LCD indicator (5 digit) with scale of Engg. unit
5	Overall Accuracy	± 0.04% or better of Span for BTG package ± 0.065% or better of Span for BOP packages ± 0.2% or better of span for remote seal type transmitter.
6	Turn down ratio	100:1 in general



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
		10:1 for vacuum/very low pressure applications. 10:1 for very high pressure application. 30:1 for other applications.
7	Stability	+ 0.15% of URL for 5 years.
8	Response time	150 msec.
9	Power supply	24V DC nominal
10	Load Impedance	500 Ohms (min.)
11	Drive capability	600 Ohms nominal
12	Enclosure Class	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
13	Span and Zero	Locally adjustable, non-interacting
14	Zero suppression / elevation	At least 100% of Span
15	Connection	
	Process	Half (1/2) inch NPT (F) Quarter (1/4) inch NPT with / without oval flanges
	Electrical	Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.
16	Accessories	
	For Absolute Pressure Transmitters	Two (2) valve SS316 manifold
	For Gauge & Vacuum pressure transmitter	Three (3) valve SS316 manifold
	For DP, level & flow transmitter	Five (5) valve SS316 manifold
	For oil and corrosive liquids	Separator diaphragm seals
	For all transmitters	Mounting bracket
	Steam Service	Syphon
17	Adjustment / calibration From hand held calibrator / centralized OWS based system / maintenance (as applicable).	From hand held calibrator/centralized OWS based system
	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

Manifold should not be mounted on the transmitter, Manifold shall be non integral and standalone type. Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. Over range protection shall be used where necessary. The coil syphons & condensate pots shall be used for steam services. Transmitters shall be provided with suitable drain & vent points.

~~Transmitters, smart positioner & other HART based instruments shall be supplied along with 4 Nos. of universal type hand held/portable calibrators. Temperature transmitters shall be supplied along with 4 Nos. of hand held/portable mV source generators/signal reader.~~

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.

Following minimum accessories shall be provided with each set:-



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- a) Soft carrying case with adjustable shoulder straps & lead compartments.
- b) HART lead set.
- c) Rechargeable batteries.
- d) Battery charger.
- e) Power adaptor.
- f) Universal plug kit for power adaptor.
- g) Load resistor.
- h) Interfacing cables of each type as per requirements.
- i) Protective boot.
- j) Standard banana jack.
- k) Operation manual & software CD.
- l) Analysis & Diagnostic Software.

For flanged remote seal diaphragm:

- a) Maximum pressure rating : To meet 200 percent of process pressure
- b) Availability of seals : for both high and low pressure sides with capillary connection in case of differential pressure transmitters and
- c) Single Capillary connection for pressure transmitters.
- d) Capillary length : 6.0 m
- e) Fill fluid : Suitable oil
- f) Process connection size : 1 inch
- g) Flange size and Accessories : As per process requirement. Flange pressure rating : Required Class (ANSI)
- h) Process liquid : Sea water, Ash water, chemical, hydrogen gas, seal oil etc.,
- i) Process fluid temperature : 25°C to 60°C
- j) Diaphragm and wetted part material : Suitable for sea water, ash water and chemical applications.(offered material to be specified)
- k) Flushing option : To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided)

ii) Pressure Switches (PS) & Differential Pressure Switches (DPS)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standards	IS3624 - 1966/ISA-RP-8.1 except as modified in spec.
2	Materials	
	Bellows	316SS
	Bourdon tube	316SS
	Movement	316SS
	Enclosure	Die-cast aluminium with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
3	Type/Construction	Bourdon/Sealed Diaphragm Piston Actuated preferable. Indicators with contacts are not acceptable.
4	Protective Diaphragm	Teflon
5	Accuracy	± One (1) percent or better of full range



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
6	Repeatability	± 0.5(half) percent or better of full range
7	Setting & Differential	Adjustable
8	Contact	
	Number	DPDT /2 SPDT
	Type	Auto reset with internal Adjustable snap action micro switch
9	Rating	5 Amp, 240V AC / 0.2 Amp, 220V DC
10	End connection	½" NPT (F) / Manufactures Standards
11	Connection - instrument	Half (1/2) inch NPT Male Process
12	Electrical	Suitable for Plug in type connection. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
13	Over range protection	One Fifty (150) percent of full scale
14	Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
15	Dead band adjustment	Adjustment up to 10% at set points.
16	Accessories	
	3 / 5 valve manifold	As applicable for all switches
	Self cleaning type pulsation dampners / Snubbers (Material SS316)	Pump and compressor
	Syphon	For all steam lines
	Protective separating diaphragm	For fuel oil & corrosive liquid lines.
	Mounting	Local (in LIE/LIR for BTG package)
17	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

iii) Pressure & Differential Pressure Gauges (PG & DPG)

S.No	Features	Essential / Minimum Requirements
1	Applicable Standards	IS:3602-1966, IS/3624, ASME B 40.1
2	Type / construction	
	760 mm to 1.0Kg/cm ²	Bellows/Diaphragm
	Above 1.0Kg/cm ²	Bourdon Tube
	Suction side of pumps	Compound gauge
3	Materials	
	Bellows	316SS
	Bourdon tube	316SS
	Movement	316SS
	Case Enclosure	SS 316 / Die-cast aluminium with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
4	End connection	½" NPT (M)
5	Protective Diaphragm	Teflon
6	Dial Size	150mm with shatter proof glass



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
7	Scale Details	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
8	Range Selection	Cover 125% of max. of scale
9	Accuracy	± One (1) percent or better
10	Instrument process connection	½" NPT Male (Back Entry)
11	Mounting Type	Local / 1/2 inch NPT Male (Back entry) mounted on local gauge board.
12	Protection Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
13	Accessories	
	3 way needle valve / manifolds	For all gauges
	Self cleaning type	Pump and compressor discharge (Pulsation dampener / Snubbers (S316) lines
	Syphon	For all steam lines
	Protective separating	For fuel oil and corrosive liquid lines
14	Other Particulars	
	External Zero adjustment / Safety device	For all gauges
	Ranges 5 to 20 Kg/cm ²	Rubber blow out disc with open front construction.
	Ranges above 20 Kg/cm ²	Neoprene safety diaphragm at the back with solid front construction.
16	Over range protection	One Fifty (150) percent of full scale
17	Over Range Test	Test pr. For the assembly shall be 1.5 to the max. Design pr. At 38°C
18	Other Requirements	Movement mechanism shall be glycerine filled for oil services & vibration prone area. For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armoured capillary of 10 M for Fuel oil & Corrosive liquid service. Contact type pressure gauges are not acceptable for interlock & protection. For condensate storage tank the pressure gauge in terms of 0-10000 mmwcl or suitable range having dial size of 300mm or bigger size shall be provided.
19	IBR Requirement	For high pressure service, Process tapping and root valves are as per IBR rules and regulations

~~2.3.3.3 Temperature Related Instruments~~

~~a) Temperature Transmitters (TT)~~

S.No	Features	Essential / Minimum Requirements
1	Type	SMART type configurable from control room through HART protocol (HMS System).
2	Display type	Indicating type (5 digit LCD Display),
3	Accuracy	±0.10%,



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

7	Ambient temperature	0-60 °C.
8	Mounting	On Top
9	Supply voltage	240V AC, 50Hz from UPS/ 24V DC
10	Relay output	2SPDT
11	Contact rating	5A min. at 240V AC on resistive load
12	Response time	100 m sec or better
13	Cable connection	¾" ET
14	Accessories	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.

k) RF type level switch

S.No	Features	Essential / Minimum Requirements
A	Electronic Controller	
1	Input supply	240 V AC from UPS
2	Construction	Cast Aluminium Housing
3	Relay Output	2 Nos. Relay Changeover Potential Free Contacts(2SPDT)
4	Contact Rating:	5A at 240 V AC & 0.25 at 220 V DC
5	Class of Protection	IP-66
6	Ambient Temperature	55 Deg. C(Max)
7	Local Indication	Local LED Indications
	Green	Normal Level
	Red	Alarm Level
	Yellow	Probe Healthy
8	Cable Connection	3/4" ET(2 Nos.) for Supply and Output & 5/8" ET(1 No.) for Probe Connection
9	Repeatability	100%
B	Sensing Probe	
1	Type of Probe	Rigid
2	Material	Stainless steel SS 316
3	Probe Head Housing	Cast Aluminium
4	Insulation (B/W Active & Shield And Shield & Ground)	PTFE
5	Probe Head Protection	IP-66
6	Mounting	Side Mounted
7	Cable Connection	5/8" ET (1No.)
8	Process Connection	40 NB BSP THREADED
9	Signal Cable	Coaxial cable for Connection Between Sensing probe and electronic Controller (@ 10 Metres. Per Level Probe)
10	Application	Ash Silos

l) Level Indicators (Gauge Glass)

S.No	Features	Essential / Minimum Requirements
1	Type/Construction	a) Reflex b) Tubular (For tanks open to atmosphere only)
2	Material:	



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Features	Essential / Minimum Requirements
a)	Glass	Tempered borosilicate resistant to thermal shock
b)	Case	Carbon steel
c)	Integral cocks	i) Forged carbon steel with drain valves stainless steel internals ii) Rubber lined corrosion resistant 316 stainless steel (for Demineralised and Osmosis water service)
d)	Fittings	i) Forged carbon steel ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralised and Osmosis water service) iii) 304 Stainless Steel for non-corrosive liquids
e)	Packing	Teflon
3	Dial size/scale	150 mm /1.5 Meters maximum length with
4	Scale details	Aluminium/SS316 scale Graduated in mmwcl
5	Connection	25 Nb/40 Nb ANSI Flanged
6	Accessories	a) Integral cocks b) Drain valves c) Bolts, nuts and gaskets d) Illuminating lamps as required e) Periscope as required
7	Tests	Tested at two hundred (200) percent of the maximum process pressure
8	Other details	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

m) Float & Board type level gauge

S.No	Features	Essential / Minimum Requirements
1	Type of Instrument	Mechanical Type (Float Operated)
2	Service/ Application	As per service requirement
3	Measuring Range	as per requirement
4	Material Specification	
a	Float Material	SS316 having 2 nos. Guide wires
b	Float Wire Pulley	Shall comprise of 2 nos. Cast Aluminium Pulley housing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative length as per P&ID
c	Guide wire Assembly	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
d	Counter Weight	MS counter – weight with Aluminium Pointer and Brass assembly Pull Chain.
e	Scale	SS 316/Aluminium material in mm with 1 % accuracy
5	Nozzle Details	For float wire pulley assembly, one tapping and for guide



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

thermal Power project of minimum 500 MW or higher size unit, which are in successful commercial operation for minimum 2 years at the date of bid opening. Bidder to furnish the necessary proof for the same in the bid offer.

Similarly, all other C&I equipments/ C&I system/instruments/PLC/SWAS/ UPS/ Charger system/Control systems/Sub systems and accessories etc, whose guaranteed and trouble free performance has been proven at least for three years, in not less than two nos. different reheat type pulverized coal fired units of unit size not less than 500 MW except some specific requirements indicated elsewhere.

Bidder shall furnish the required information/details/PTR to fully satisfy the owner regarding successful operation and high reliability of products/systems offered/furnished.

The bidder shall obtain & furnish the certification from his tieup partners (as consortium or other wise) that their design, engineering, procurement, manufacturing, erection, commissioning and shop test facility are adequate to meet the specified technical & performance/quality requirements for execution & commissioning of the package offered to the satisfaction of owner.

Standardization and Uniformity of Hardware

To ensure & provide smooth and optimal maintenance easy interchangeability and efficient spare parts management of various C&I instruments/equipment like vibration monitoring systems, all 4-20mA electronic transmitters/ transducers, control hardware, control valves, actuators and other instruments/ local devices etc. being furnished by the Bidder for main plant areas (eg. boiler/turbine etc.) and other plant and station auxiliaries for similar applications, the Bidder shall ensure that they are of the same make, series and family of hardware.

To ensure smooth and optimal maintenance easy interchangeability and efficient spare parts management of various C&I instruments/equipment like vibration monitoring systems, all 4-20mA electronic transmitters/ transducers, control hardware, control valves, actuators and other instruments/ local devices etc. being furnished by the Bidder for main plant areas (eg. boiler/turbine etc.) and the Bidder shall ensure that they are of the same make, series and family of hardware.

The bidder shall obtain & furnish the certification from his tie-up partners (as consortium or otherwise) that their design, engineering, procurement, manufacturing, erection, commissioning and shop test facility are adequate to meet the specified technical & performance/quality requirements for execution & commissioning of the package offered to the satisfaction of owner.

2.3.2.8 Redundancy Criteria for Sensors and Signals from MCC/SWGR

Redundancy of components and systems shall be dictated by availability criteria described under DDCMIS/DCS/PLC to ensure the system availability target as well as safety considerations in critical applications are fully met.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Bidder shall also introduce redundant control equipments or instruments wherever it is felt by owner that the introduction of the same shall lead to reduction of downtime of plant and equipments, in addition to the case/criteria clearly defined/identified in the specification.

Triple redundancy or dual redundancy for signals from MCC/SWGR, sensors and transmitters will be used for critical control /Protection application, critical monitoring application & other control/interlock applications. Where correction/ compensation for the measured signal are involved, the computed signal shall be the one transferred for control purposes. The measured value indicated shall be the duly corrected/ compensated signal.

Sensor/signals/measurements redundancy required (2 out of 3 or 1 out of 2) requirement have been specified in respective control system specifications and as specified elsewhere in the technical specification. However, sensor/signals/measurements utilization will be decided during detailed engineering. It is mandatory to use sensors/signals/measurements with 2 out of 3 logic for critical control & protection (Analog & Binary) application/service and sensors with 1 out of 2 logic for all other control & interlock (Analog & Binary) application/service as explained below.

2.3.2.9 Triple measurement scheme

Triple measurement scheme for analog inputs employing three independent transmitters connected to separate tapping points shall be employed for the most critical measurements. The same shall be used in analog control functions including, the following but not limited to, furnace draft, feed water flow, Feed Water Temperature, feed water pressure before Economiser, Discharge Flow of each BFP, BFP discharge Temperature, Boiler Separator level control, Steam Pressure, Main steam, CRH & HRH, steam temp. control, SH spray Flow, RH spray Flow, throttle pressure, PA/SA Air Flow, PA/SA Air Temperature, PA header pressure, Mill Air Flow, Mill outlet Temperature, Coal Feeder Speed Control, Spray water flow, SH, RH & Aux. Steam Desuperheater inlet & outlet Temp at each stage, SH Platen Steam Temperature before Desuperheater, SH Platen Steam Temperature after all super heaters, RH steam Temperature at Turbine end, Main steam Temperature at turbine end, turbine first stage pressure, Deaerator level, Deaerator Flow after Last LPH, Hot well level, GS steam Pressure, condensate flow before recirculation line, turbine speed, Turbine Control Valve position, Power measuring device, HP/LP Heater level, SCAPH temp. Control, HP Bypass controls, LP Bypass controls, Light Oil Pressure, Heavy Oil Pressure, Atomising Steam Pressure, Heavy Oil Temperature, Hydrogen gas pressure of generator, Atomising air pressure, TDBFP steam pressure, TDBFP steam temperature, TDBFP controls, BFP speed control, Turbine lube oil temperature, Turbine main oil tank level and all other trip & protection logics etc.

For MFT/FSSS/BMS/Turbine protection/ Generator/Unit tripping, triple sensors shall be provided. For Binary and analog inputs required in major equipment (Furnace, Turbine, tripping/protection of any HT drive etc.) protection triple-sensing devices shall be provided. Binary and analog inputs, which are, required for protection of more than one equipment as well as protection signals for HT Drives (fed by a supply feeder of ratings 6.6 kV onwards)/MDBFP/TDBFP etc., triple sensing devices shall be provided.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Triple sensors shall be provided for Instruments required for auto starting of HT driven pumps or pump tripping due to very low level of water/discharge pressure very low and Trip of any auxiliary which will lead to substantial (50%) loss of unit availability. For lube oil protection of all the HT drives, 2 out of 3 logics and necessary pressure transmitters for lube oil pressure shall be provided by bidder accordingly. Left and right side shall be treated as individual path / individual parameter, and each side/path shall have own triple redundancy accordingly.

2.3.2.10 Dual measurement scheme

For binary and analog inputs required for other modulating control, protection and interlock purpose of other equipment and other critical monitoring application etc., minimum dual sensors shall be provided. Dual sensors shall be provided for instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/discharge pressure very low. Dual sensors shall be provided for instruments required for Heat rate measurements & PADO calculations.

Dual measurement scheme for analog inputs employing two independent transmitters/ temperature element, connected to separate tapping points shall be employed for the remaining measurements used for analog control functions.

Dual duplex Temperature Elements shall be provided before and after of each LP Heater and HP Heater on water lines.

Dual redundant position transmitters shall be provided for Steam Admission Valves i.e. (Main steam Stop & Control Valves, Reheat steam Stop Valves & Control valves and TDBFP steam stop valves & control valves), Extraction steam QCNRV, CRH NRV.

Dual analysers shall be provided for chemical dosing controls and O2 dosing controls.

For binary and analog inputs used for alarm and monitoring only, single sensor criteria shall be applicable.

All the instruments/sensors/transmitters/switches meant for redundant applications shall have completely separate and independent impulse pipes/ root valves etc. No redundant instrument shall share a single process tapping. There will be separate and independent tapping for every individual instrument.

2.3.2.11 Back-Up Instrumentation

- a) No full backup discrete hardwired based control or hardwired manual operation is envisaged in the 800 MW Unit control room for main plant. Bidder shall however perform a failure analysis to establish that the plant can be safely shutdown or can be brought to a safe operating condition without any damage to equipment and / or personnel during the unlikely event of catastrophic failure of DDCMIS/DCS.

ERECTION HARDWARE



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

CHAPTER-8

ERECTION HARDWARE

2.3.8 Erection Hardware - Process Connection and Piping

2.3.8.1 General Requirements

This section covers the material requirement for instrument connection to process, instrument process, piping, tubing, supports, Instrumentation cables, control cables and compensating cables/Extension cables, transmitter racks and main accessories to be furnished under this specification and the requirements of installation and routing. Impulse lines, fittings and other accessories required for the erection of complete Instrumentation and Control System supplied under various packages of this specification shall be supplied on "as required" basis. Bidder shall offer all necessary items for this section based on his experience on similar plants, plant layout diagrams, installation drawings and other applicable sections of this specification. Based on the good engineering practices Bidder shall furnish installation drawings during the engineering of the system for Owner's review and approval. The installation of the drawings shall be suitable for his installation of his range of instrumentation.

The Bidder shall furnish and test all required erection hardware, which is necessary for proper installation and interconnection of the equipment/systems furnished by the Bidder and their integration with main equipment/systems as per the enclosed installation drawings and other applicable clause. The Bidder shall furnish all hardware and accessories to ensure that the equipment/systems furnished form a complete and operational system meeting the intent and requirement of this specification.

All materials, furnished shall conform to the latest editions of America National Standard Code for Pressure piping, Power piping, ANSI B31.1, ANSI B16.11, ASME Boiler and Pressure Vessel Codes, IBR and other applicable ASME, ANSI and Indian Standards. Schedule numbers, sizes and dimensions of all carbon steel, stainless steel and alloy seamless steel pipe shall confirm to ANSI B.36.10 and of stainless steel pipe shall confirm to ANSI B 36.19 unless otherwise specified.

All materials supplied under this section shall be suitable for intended service; process operating conditions and type of instruments used and shall fully conform to the requirements of this specification.

The Bidder is responsible for the performance of the equipment furnished on system basis any shortfall in erection material observed during erection stage shall be compensated by the Bidder at no extra cost. ~~(Installation drawings # LH-GEOE15066-I-45786-001 to 29 shall also be referred by bidder).~~



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

5) Fittings:-

Forged cast steel A234 Gr. WPM galvanized inside and outside; screwed as per ASA B2.1 dimensions as per ASA B16.11, rating 2000 pounds, elbows and soft seats. The size of the fittings shall be ½ inch through 2 inch.

6) Air Filter Regulator Set:-

An instrument Air Filter Regulator Set with mounting assemblies shall be provided for each pneumatic device requiring air supply.

7) Instrument Air Piping System:-

Instrument Air shall be made available by the bidder at 3.5 to 7.0 Kg/cm² pressure. The instrument air may be arranged as under:-

- i) For the control valves and power cylinders in owner's scope but controlled by bidder's control system, the instrument air requirement for E/P converter shall be tapped from the nearby instrument air header laid by bidder / already laid existing piping with accessories available near the control valves or damper. Complete hardware required for interfacing with Owner system shall be in bidder scope.
- ii) Air supply piping shall be installed at site always with a slope of over 1/100 to prevent accumulation of condensed water within the pipe.
- iii) All joints in the instrument air sub-header shall be of screwed type.
- iv) Instrument airline shall be separate for each individual instrument, equipment & drive with own isolation valve and other required hardware. Tee off of instrument line for two or more same/similar services instrument, equipment & drive are not acceptable.
- v) Instrument air flushing/purging lines shall be provided for Bowl Mill DP, secondary air flow measurement instrument and other all flue gas services instruments etc.

8) Signal / Control Air Tubing System:-

Necessary tubes with fittings and accessories for output signal from pneumatic instruments mounted in the field and control signals to final control elements shall be covered under this tubing system.

2.3.8.3 Specification for Erection Hardware

The erection hardware shall meet the following specifications:-



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

a) Impulse piping

S.No	Item	Specification
1	High pressure and high temperature services (Medium: Steam & Water and furnace region)	Seamless Alloy Steel piping to ASTM A335 GR.P91 / 22 (schedule XXS / 160 for high pressure & high temperature)
2	Low pressure and low temperature services (Medium: Steam & Water)	Seamless carbon steel piping to ASTM A106, Gr. C
3	Low pressure and low temperature services (Air, Flue gas)	ERW carbon steel piping to IS 1239:1973 Heavy class System)
4	Steam and water analysis system	Seamless stainless steel piping to ASTM A312 GR. TP-321
5	Seamless copper tubing	ASTM B-75

b) Fittings Double compression type

S.No	Item	Specification
1	Material for socket weld fittings	ASTM A105, ASTM A182, Gr. F22 6000/3000 lbs
2	Dimensions of fittings	ANSI B16.11
3	Fittings for steam and water analysis.	Gr. F-321

c) Valves

S.No	Item	Specification
1	3 – way valves	SS body/forged CS body stellited internals and SW ends as per requirement for 2500 lb/800 lb ASA ratings.
2	5- valve manifolds	FAS body/FCS body 316SS stellited internals with NPT (F) SCRD ends for 3000/2500 lb/1500 lb/800 lb ASA ratings. Construction – Single block (Bar stock)
3	3-valve manifolds	FAS body/FCS body 316SS stellited internals with NPT (F) SCRD ends for 3000/2500 lb/1500 lb/800 lb ASA ratings. Construction – Single block (Bar stock)
4	2-valve manifolds	FCS body, 316SS stellited internals, NPT (F) SCRD ends. Construction – Single block (Bar stock)
5	Isolation and drain valves	Globe valves with FAS body/FCS body, 316SS stellited internals SW ends for 3000/2500 lb/1500 lb/800 lb ASA ratings.

d) Other Fittings items

S.No	Item	Specification
1	Condensation vessels	FAS/FCS body with NPT (F) SCRD connection and vent plugs for 3000/2500/1500/800 lb ASA ratings.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Item	Specification
2	Racks and Associated Equipment	ANSI C83.9-1972
3	Code for pressure piping, welding and Hydrostatic testing	ANSI B-31.1
4	Flexible conduits with fittings	Lead coated, paper insulated, heat resistant flexible metallic conduits with necessary fittings.
5	3 Valve manifold shall be used, wherever Diff Pressure transmitter / switch have been used for pressure measurement.	
6	5 Valve manifold shall be used for Diff. Pressure & Flow measurement Transmitters / Switches.	
7	In addition to above, table # 8.1 shall also be followed for selection of specific erection hard ware as per process requirements.	

2.3.8.4 Transmitter & Switches Enclosures

In general, BTG process transmitters & switches installed at outdoor location and in areas where they are subjected to splashing oil, water, steam etc., shall be mounted in closed type transmitter rack. For other areas (indoor), open type racks may be used for installation of transmitters and process switches. However the actual requirement shall be finalized during detailed Engineering considering following:-

- Transmitter/Switches enclosures shall be free standing, enclosed type offering protection against dust, moisture and vermin. Enclosures shall be suitable for outdoor installations, in thermal power plants.
- The enclosures shall comprise of Galvanized Sheet mounting plate internally. Also external-mounting brackets in Polyamide or Stainless Steel shall be available. Alternatively transmitter enclosures can be glass Fiber Reinforced Polyester (GRP) compression moulded and shall be weather proof.
- Instrument piping inside the enclosure shall conform to the specification and in line with typical installation drawings enclosed with the specification.
- Blow down header shall be provided inside the enclosure as called for.
- Bulk head connection shall be provided to receive and terminate the impulse pipes from root valves.
- Instrument tubing, fittings and isolation, drain valves shall be to ANSI code for pressure piping. Piping/tubing shall be subject to hydrostatic tests at 1.5 times maximum system pressure.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- g. Support angles shall be provided for valve manifolds, wiring trays etc. Enclosures shall be complete with necessary bulk head fittings, junction boxes, drain header and other accessories as needed on the basis of approved hook up drawings.
- h. Sufficient spacing among adjacent transmitters shall be maintained to offer easy accessibility and operational convenience. The enclosure shall be designed with sizes to suit the grouping and to completely include all the hardware for hooking up the transmitters to the process on the basis of approved installation diagrams. A maximum of five (5) transmitters are envisaged to be grouped in one enclosure.
- i. A minimum of twenty (20) percent spare terminals shall be provided. Only one wire per terminal shall be used on the outgoing side of these blocks (for cable panel). Any common connections required shall be provided on the panel side of the block. All incoming power terminals are to be clearly identified in a manner distinctly different from all other terminals and grouped in a logical pattern.
- j. Chapter no. 6 of this volume shall also be referred for designing of Transmitter / Switches enclosures.

2.3.8.5 Local Instruments, Local Boards and Tapping Points

- a. All local gauges as well as sensors, Transmitters and switches any other instruments for parameters like pressure, temperature, level, flow etc. for safe and efficient operation of equipment under the scope of specification, shall be provided by bidder as approved by Owner. Such equipment shall be listed by the Bidder detailing the items with the respective functions in service. All field mounted instruments shall be mounted in such a way as not to be affected by vibration & environmental conditions. Racks to mount these instruments shall be furnished by bidder complete with requisite erection hardware, tubings and junction boxes with all terminals of the instruments duly wired complete with cable glands. Groupings of instruments, actual number of racks for instruments and its construction shall be to Owners approval.
- b. Transmitters & Switches provided shall be mounted in transmitter/Switches enclosures to owner's approval. The junction box for electrical connections shall be outside the transmitter enclosures.
- c. All erection hardware required for complete installation/ implementation of entire instrumentation specified is included in bidders scope. Any change in size, type, rating or in quantity deemed necessary during engineering shall be supplied within package price with no additional financial implication to owner.
- d. Bidders scope includes providing counter flanges on pipe lines/ vessels to suit owner arranged flanged devices. Counter flanges shall be complete with gaskets, nuts, bolts and other requisite accessories for proper installation.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- l) At CW & ACW pump discharge headers flow transmitters shall be provided (Non Contact ultrasonic Type are preferable). In addition flow measurement shall also be provided for CW water used anywhere except condenser service.
- m) Flow transmitters for general applications shall be of the differential pressure type
- n) Flow switches for OLCS / Alarms / Interlocks / Protection.
- o) Lubricating oil Flow transmitter/meter with switch shall be provided for Bearing systems of APH, FD, PA, etc.,
- p) Sight glasses flapper indication type shall be provided on lube oil cooling water piping as required to ensure indication of fluid flow.
- q) On line Fuel flow & velocity measurement facility in each Pulverized Fuel (PF) pipe for each coal pulveriser shall be provided by bidder for accurate, absolute and simultaneous measurement of coal velocity, coal density, coal mass flow rate and air-to-fuel ratio. The equipments shall compromise of sensors working on micro wave technology.
- r) In addition to the conventional triple DP measurement techniques involving venturi/Aerofoil for secondary air flow measurement, One number Flow measurement system each on Left side and Right side shall be provided as redundant/checking measurement for secondary air flow which could be used in the optimization package.
- s) On line secondary air flow & velocity measurement facility in each on left side & right side shall be provided by bidder for accurate, absolute and simultaneous measurement of air velocity & flow rate. The equipments shall compromise of sensors working on tribo-electric (Correlation technique) technology.
- t) Any other flow element/meter required for system shall be finalised as per system requirement and as per approved drawings/documents by owner.

5. Process Connections

- a) The type of instrument source connection shall depend upon the process parameters and the tapping size. The source connection drawings shall be finalised during the engineering stage.
- b) Size of tapping point stub, number and size of root valves for different types of measurements are as follows:



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No.	Quantity of root valves	Size of stub and root valve	Service Condition
Pressure and Differential Pressure Measurement			
(i)	2	25NB	$\geq 40 \text{ bar (g) OR } 425^{\circ}\text{C}$
(ii)	1	15NB	$< 40 \text{ bar (g) AND } 425^{\circ}\text{C}$
Level Measurement			
(a)	Level Gauge & Switch		
(i)	2	25NB	$\geq 40 \text{ bar(g) OR } 425^{\circ}\text{C}$
(ii)	1	25NB	$< 40 \text{ bar(g) AND } 425^{\circ}\text{C}$
(b)	Level transmitter (displacement type)		
(i)	2	40NB	$>40 \text{ bar(g) OR } 425^{\circ}\text{C}$
(ii)	1	40NB	$<40 \text{ bar(g) AND } 425^{\circ}\text{C}$
(c)	Stand pipe for level measuring instrument		
(i)	2	80 NB	$\geq 40 \text{ bar(g) OR } 425^{\circ}\text{C}$
(ii)	1	80 NB	$< 40 \text{ bar(g) AND } 425^{\circ}\text{C}$
Flow Measurement			
(i)	2	25NB	$\geq 40 \text{ bar(g) OR } 425^{\circ}\text{C}$
(ii)	1	25NB	$< 40 \text{ bar(g) AND } 425^{\circ}\text{C}$
Sampling system measurement (Steam and Water Service)			
(i)	2	25 NB	$\geq 40 \text{ bar(g) OR } 425^{\circ}\text{C}$
(ii)	1	25 NB	$< 40 \text{ bar(g) AND } 425^{\circ}\text{C}$

LOCAL PANEL



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

9. Fire/Smoke Detector, Neoprene/silicon Gasket, Exhaust Fans with louvers & filters shall be provided in all consoles and panels.
10. All the panels shall be equipped with Anti vibration pad of 15 mm size.
11. PLC with OWS –
 - a) All winding/Bearing Thermocouple/ RTD shall be connected to PLC.
 - b) All analog inputs i.e. Temperature, Pressure, flow, level, vibration etc. shall be connected to PLC.
 - c) Only important parameters shall be display on desk / Panel.
 - d) Bidder shall provide Ammeter on panel for all HT Motor current & > 15 KW LT Motor and very important LT drives as decided during detail engineering.
12. PLC without OWS based control System –
 - a. All winding/ bearing Temperature, T/C, RTD shall be connected to 16point microprocessor based Temperature Scanner and mounted on panel for every HT motor / pump / auxiliaries.
 - b. Illuminated PB shall be provided for Start / Stop, ON / OFF indication on the Desk / Panel.
 - c. Panel mounted Indicator/ Recorder shall be provided for flow, Temperature, Pressure, Level, vibration etc. for all analog points.
13. Bidder shall provide Ammeters on control panel/desk for all HT motor current and LT motor current > 15 KW & other important critical LT drives.

2.3.4.40 Relay Based Local control panel / Desk

Local control panel shall be of 2.5 mm steel construction, free standing type, totally enclosed dust and vermin proof with enclosure protection class of IP-55 as per IS: 13947 and colour shall be as per shade no. RAL 7032/7035. Panel shall be mounted on vibration dampers secured to steel frame on to the floor. Equipment and relays mounted on the panel shall be easily accessible. The panel shall be supplied completely wired upto terminal blocks for connecting external cables entering the panel from the bottom. Blank removable gland plate shall be provided with double compression type cable glands/conduits knockout along with the panel.

Terminal block shall be rated 600 volts minimum and shall have strap cage clamp type screw less terminals suitable for connection with 2x2.5 sq mm copper conductors on each side. Terminal block shall be provided with white marking strips. Fuses shall not be mounted on terminal blocks. At least 20 percent spare unused terminals fully wired shall be provided on terminal block.

Contactors, Relays, timers and other devices mounted on the panel shall have clearly visible identification marking. Separate contactors shall be provided for start & stop command. Common contactor for start & stop command are not acceptable. All fuses shall be HRC semiconductor type of AC supply. HRC link & fuse shall be of removable type having 45 kA rupturing capacity (min) for



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

protection of various circuits.

The panel shall be provided with a 50x6 mm tinned copper earthing strip running throughout the length of the panel at the bottom. Panel shall be provided with space heaters with isolating DPN MCB, and thermostats. LED based illuminating lamps, complete with door switches; and 1 no. 6 pin 5/15amps sockets with DPN MCB. Separate power supply feeder shall be provided for utilities.

Panel shall be provided with LED illuminating lamps with door switch and 6 point 5/15A, 240V AC socket with switch for maintenance purposes. Panel shall have removable lifting eye bolts for safe lifting from top during handling.

Control power supply shall be provided from dual redundant UPS feeders with auto change over scheme, surge protection devices and Power/Volt/AM meter. In case UPS feeders are not available, control power supply shall be provided from dual non UPS single phase power supply feeders with dual transformers and with auto change over scheme, surge protection devices and Power/Volt/AM meter.

The panel shall be provided with push buttons, indicating lamps, annunciators, indicating instruments, interlock/ deinterlock switches etc., required for the complete system. General details as specified in ~~chapter 6~~ shall also be referred for engineering and design of relay panel/desk.

~~Coloured Mimic with 6mm thickness sheet for respective plant lay out shall be provided as specified in Annexure A, control system philosophy.~~

20% spare relays of each type and rating shall be mounted and wired in relays control panel/Desk. All contacts of relays shall be terminated in terminal blocks of relay control panel/Desk, Additionally in the relay control panel/Desk, 20% spare terminal blocks shall be 'provided so that additional relays can be mounted and wired.

The annunciation system shall consist of panel mounted audio-visual windows of 50x75 mm provided with plug-in-type solid-state logic 16 nos. high intensity LEDs in parallel. EACH relay based control panel shall be provided with 30 nos min. facia windows. Initiating contacts may be either NO or NC; a jumper or switch shall be provided in each card to make it suitable for either type of contact. A set of acknowledge, reset and test push buttons shall be provided on the panel. All printed circuit boards shall be of epoxy fibre glass construction.

The sequence of annunciation shall be as follows:

S.No	Condition	Visual	Audiable
1	Normal	OFF	OFF
2	Alarm	Flashing	ON
3	Acknowledge	Steady	OFF
	Return to Normal		
4	Before acknowledge	Flashing	ON



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

S.No	Condition	Visual	Audiable
5	After acknowledge	Steady	OFF
	Reset		
6	Alarm condition	No change	No change
7	Return to normal	OFF	OFF

2.3.4.41 Online computer aided microprocessor based machinery maintenance management system (OCAMMMS)

One no. Microprocessor based standalone online vibration / machinery monitoring and analysis system shall be used for condition monitoring, analysis & diagnostic of STG and HT drives / motors with fans / pumps, air compressor, and any other HT drives envisaged for subject plant. OCAMMMS shall take care of predictive maintenance of machine / equipment. And shall be compatible and of same family of turbine vibration monitoring system / HT drives vibrations system. For OCAMMMS a dedicated colour Operating station with 24" industrial type LED monitor & A4 color LJP and separate OCAMMMS redundant server (Server shall be capable to store bulk data for 5 years duration with facility for retrieval of same) shall also be provided to achieve the functions described under following items.

a) General Description

The bidder shall furnish a programmable online Machinery Management System that automatically acquires processes and displays vibration and process data for critical machinery. The monitoring system shall interface via redundant bidirectional (Ethernet / RS 485 Modbus) links to one or more plant process computers or controllers / VMS as well as provide input to a Windows NT based Machinery Management System for trending vibration and process data for on-line machinery diagnostics. The system shall have the capability to be networked (single or multiple client / server) using Windows NT-compatible protocols on both LANs and WANs. It shall also have the capability to be accessed remotely through a telephone line and to interface via Modbus serial or Ethernet link to one or more plant process computers or controllers, as well as to interface with network devices to obtain process data. Any signal required for interlock / trip / protection from TSI / VMS shall be hard wired to DDCMIS. Redundant connectivity shall be provided between TSI / TSS / VMS rack & OCAMMMS OWS.

b) Online Machinery Protection & Monitoring System

Latest monitoring system should be supplied. The monitoring / protection system should be compliant to API670 (Latest edition) and must meet the detailed specifications placed below.

c) High speed multi-channel online–Data acquisition communication processors (CPs)

Fully online and continuous data acquisition (communication) processors shall be supplied for all channels. For dynamic channels, sufficient sampler cards shall be supplied. The Data Acquisition CPs must comply or be better than detailed specifications placed below.

	SPECIFICATION FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS -999- 145 -054A	
			VOLUME	II B
			SECTION	D
			REV. NO. 03	DATE : 16-09-2013
			SHEET	1 OF 6

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others

Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)

Gland plate thickness: 3.0mm

Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

	SPECIFICATION FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS –999- 145 –054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	2 OF 6

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte

	SPECIFICATION FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	3 OF 6

Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

~~3.2 Hazardous Area Panel Requirement~~

~~3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.~~

~~3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.~~

~~3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.~~

~~3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.~~

~~3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.~~

~~3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).~~

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

	SPECIFICATION FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME II B	
		SECTION D	
		REV. NO. 03	DATE : 16-09-2013
		SHEET 4	OF 6

3.3.5 Control / Selector Switches
Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights
The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters
Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)
These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

	SPECIFICATION FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS –999- 145 –054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	5 OF 6

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

	SPECIFICATION FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS –999- 145 –054A	
			VOLUME	II B
			SECTION	D
			REV. NO. 03	DATE : 16-09-2013
			SHEET	6 OF 6

5.0 SPARES AND CONSUMABLES**5.1 Commissioning Spares and consumables**

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS**6.1 The bidder shall furnish the following documents in required number of copies along with the bid :**

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING**7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.****8.0 APPLICABLE DATA SHEET FORMS**

This document shall be read with one or more of the following data sheet forms :

- | | | |
|-----------------------------------|---|-------------------------------|
| - Data sheet A&B for Local Panels | : | Data sheet no. PES-145A-DS1-0 |
| - Data sheet C for Local Panels | : | Data sheet no. PES-145A-DS2-0 |



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Control panel cum desk with HW annunciation windows, ILPBs, Ammeters, Annunciation & desk PBs, mimic, lamps, Indicators, recorders, etc. shall be provided. (Exact service & quantities will be worked out & approved during detailed engineering by owner).

Two (2) nos. vertical Steel Almirah shall be provided for keeping documents in BTG package's control 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 engg.

Suitable lockers (min. 24 nos.) shall be provided in the room adjacent to the central unit control room for storing of personal articles of control room personnel. Vertical Steel Almirah shall also be provided for the following rooms, wherein final quantity may be decided by owner during detailed engineering

- a. Maintenance room – 6 nos. min.
- b. ERP room – 2 nos. min.
- c. PADO Room – One (1) no. min
- d. Station In charge room – One (1) no. min
- e. Simulator room – 4 nos. min.

Thickness of steel almirah sheet shall be 18 gauges.

In addition to above, All industry grade furniture including chairs, control tables, tables for printers etc. & Almirahs for storage of consumables / catalogues / manuals shall also be provided by the bidder as on required basis and finalized by owner anywhere in power plant. Details shall be finalised and approved by Owner during detailed engineering.

Control panels for service system like C.W. Pumps etc. will be located in the respective control room. In addition, some local panels will be provided near respective system / equipment such as Boiler Feed Pump, Hydrogen seal oil system, Electrostatic precipitator etc.

2.3.6.4 Termination / Marshalling Cabinets & Interposing Relay Panel

Marshalling / Termination cabinets for the control system shall be supplied for terminating all cables originating from the field, MCC / SWGR or any other source of signal and for distributing the signals to different functional panels, MCC / SWGR and control cubicles.

Incoming cables from the field, MCC / SWGR or any other source of signal shall be terminated in suitable terminal blocks in logical sequence.

Prefabricated cables with plug in connectors at both ends shall be used for extending the signals to the functional panels. Matching plug sockets shall be provided in the termination cabinets for terminating the plugs.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Interposing relay panels for the system shall be supplied for mounting interposing relays & terminating all cables originating from the DO cards in case of solenoid valves, and other required services etc. IPR panels shall be placed in CER and LCR.

Interposing relay shall be mounted in respective SWGR / MCC / integral starter required for commands signals of HT / LT unidirectional drives and bidirectional drives, breakers, isolators & bus couplers etc. from DDCMIS / DCS or any control system. Terminal blocks shall be located inside the cabinets on support wings fabricated of metal plates. Similarly suitable lockers (min. 8 nos in each control room) shall be provided in BOP package / BTG offsite control rooms shall be provide by bidder.

The plug socket shall be mounted on hinged plates to provide an access to the rear pins of the plugs. General features of termination cabinets and accessories shall conform to the general design and construction specification of panels. Terminal blocks shall be Rail mounted Terminal blocks (Screw less cage clamp type) with markers.

2.3.6.5 Constructional Features of Panels, Consoles, Control Desk, Cubicles & Enclosures

All panels, cubicles, consoles, SOV panels and enclosures furnished as per this specification shall be of free standing type and shall be constructed of specified gauge of steel plates. The panel sheet thickness shall be not less than 2mm unless otherwise specified herein.

The panels, consoles / desks shall be reinforced as required to ensure true surfaces and adequate support for instruments mounted thereon. All instrument cut outs, mounting studs, and support brackets shall be accurately located. All welds on the exposed panel surfaces shall be ground smooth. Finished panel surfaces shall be free from waves, bellies, or other imperfections. Unless specified, otherwise, panel doors shall be 4 points hinged and shall have turned back edges and additional bracing where required to ensure rigidity. Door hinges shall be of the concealed type. Door latches shall be of the three-point type to ensure tight closing. Door locks shall be furnished which will allow actuation of all locks by a single master key. All panels shall have removable lifting eyebolts for safe lifting from top during storage and installation handling.

Cabinet doors shall be hinged and shall have turned back edges and additional bracing where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three / four-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is equal or more than 800 mm, double doors shall be provided.

All panels shall be mounted on vibration dampers, which are secured to channels mounted on the floor. The channels shall be field welded to steel plates set into the concrete flooring. The steel plates shall be located such as to approximate the outline of panel bases. The exact mounting details shall be as approved by the owner during detailed engineering stage. All panels shall be provided with adequate ventilation and packaging density of components shall be restricted so as to limit the



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

temperature rise above ambient to 10°C under the worst conditions. All panels shall have auto on/off switch for internal lighting. All the power supply circuit for control panels shall be provided with auto changeover circuitry.

In each panel / cabinet, a 24 VDC Voltmeter digital type shall be provided to check the Field Interrogation voltage.

Exhaust Fans with louvers & filters shall be provided on door's (front & Rear) upper side to remove hot air in all consoles, control desk and panels.

Fire / Smoke detectors shall be provided inside the Control room mounted system / control cabinets.

UPS, 24V DC & non UPS's Feeder failure / healthy indication shall be provided in each cabinet & remote indication shall be hooked up to DDCMIS / DCS / annunciation & suitably grouped.

All the panels shall be equipped with Antivibration pad of min. 15 mm size. Cable gland plate thickness shall be 3 mm.

Doors shall be provided with neoprene / polyurethane gasket only.

All the cable entries shall be at the bottom of electronic cubicles / control panels. Protection class of panels shall be as specified at Vol. II, chapter 2.

a) Operator Control Desk

In CCR, Operator work station consoles / desk shall be of granite top of curved nature with powder coated frame. OWS consoles shall be provided with the facility for locating the CPU, document etc. with all required utilities.

Unit In charge desk / consoles shall be of granite top of curved nature with powder coated frame. OWS consoles shall be provided with the facility for locating the CPU, document etc. with all required utilities.

Station In charge desk / consoles shall be of granite top of curved nature with powder coated frame. OWS consoles shall be provided with the facility for locating the CPU, document etc. with all required utilities.

Engineer work station and all other consoles / desk shall be ergonomically designed industrial grade type with swivel chairs for use at the various Programming stations and all other plant locations. All the equipment like Programmers stations, PC's, various peripherals & similar devices shall be complete with desks and they shall be of industrial grade stands and other mounting accessories and the same shall be completely erected & commissioned by the bidder. Details for other operating and engineering stations shall be as below:

1. Operator Control desk shall be free standing table top type with doors at the back and

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.:	
				VOLUME	
				SECTION	
				REV. NO.	DATE:
				SHEET 1	OF 1
TAG No. Qty.....			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 (Steel) ☐ WELDED (As per requirement)		
	ENCLOSURE SHEET THICKNESS	FRONT	☒ 2.5 mm		
		OTHER	☒ 2.5 mm (Gland Plates- 3.0 mm)		
DOOR		☒ 2.5 mm			
TECHNICAL	INPUT POWER SUPPLY		☐ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE, 4WIRE		
	NO. OF FEEDERS		☐ ONE ☒ TWO		
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☒ During detailed engg. (As per requirement)		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		AS REQUIRED		
	PAINT TYPE		☐ EPOXY ENAMEL ☒ EPOXY POWDER COATED		
	PANEL COLOUR (EXTERNAL)		☒ Exterior- RAL 7032/7035, to be finalized during detailed engineering.		
	FINISH		☒ MATT ☐ GLOSSY ☐ SEMI GLOSSY		
	PANEL COLOUR (INTERNAL)		☒ BRILLIANT WHITE ☐ CREAM ☐ OFF WHITE		
	FINISH		☐ MATT ☐ GLOSSY ☒ SEMI GLOSSY		
	CLASS OF PROTECTION		☒ IP-55 ☐ IP-65		
	CONTROL HARDWARE		☒ RELAY BASED		
	FOUNDATION ARRANGEMENT		☒ FOUNDATION BOLTS ☐ ANCHOR FASTENERS		
	WEIGHT OF PANEL (Kg.)				
	PANEL TYPE		☐ PRESSURISED ☒ UNPRESSURISED As per Requirement		
	CABLE GLAND		☐ SINGLE COMPRESSION ☒ DOUBLE COMPRESSION		
	AMMETER (TYPE OF INPUT)		☒ 1 Amp CT ☐ 4-20 mA		
NAME SIGNATURE DATE	PREPARED BY		CHECKED BY		APPROVED BY
					COMPANY SEAL
					NAME
					SIGNATURE
					DATE

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.:	
			VOLUME	
			SECTION	
			REV. NO.	DATE:
			SHEET 1	OF 1
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			
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
DOOR				
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH			
	PANEL COLOUR (INTERNAL)			
	FINISH			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE			
	CABLE GLAND			
	AAMETER (TYPE OF INPUT)			
	NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY

shall be constructed of 3 mm thick CRCA steel plates. It shall have concealed cable & wire way management system. The top surface of control desk shall be 30mm thick with the top 12mm of acrylic solid surface and the remaining 18mm of laminated medium density fibre board. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, Mouse pads, Monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal & vertical directions.

2. To achieve durable & water resistant finish, a sheet of "plastic PVC membrane" on the surface of control desks shall be provided. Final paint finish with proper smoothening is to be ensured. Final finish of CD should be in line with relevant International standards. For more durability, the membrane sheet of the Control desk should extend 200 mm more into the underside of the desk. The cabling / wiring between OWS & CPU's, power supply cables etc. shall be aesthetically routed and concealed from view.
3. All the control desk shall be equipped with Anti vibration pad of min. 15 mm size. Cable gland plate thickness shall be 3 mm.
4. Doors shall be provided with neoprene / polyurethane gasket only.

b) Surface Preparation and Painting

All panel exterior steel surfaces shall be ground smooth, and painted as specified below: Suitable filler shall be applied to all pits, blemishes and voids in the surfaces. The filler shall be sand blasted so that surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be ground burr free. The entire panel surface shall be sand blasted 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. Alternatively 7 tank process shall be followed.

Two spray coats of inhibitive epoxy primer surface shall be applied to all exterior and interior surfaces, each coat of primer surface shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalysed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mil. The finish colours for exterior and interior surfaces shall conform to the following shades:

- a. Exterior - RAL 7032 / RAL 7035.
- b. Interior - Glossy white two coats / RAL 7035 with fire resistant paint

One uniform colour shade as finalized shall be applicable for complete plant. Paint films, which show sags, checks, blisters teardrops, fat edges or other painting imperfections, shall not be acceptable and if any such defects appear, they shall be repaired by and at the expenses of the Bidder.

c) Panel Wiring

Interconnecting wiring shall be provided between all electrical devices mounted in the panels, and between the devices and terminal blocks if the devices are to be connected to equipment outside the panels by cabling and through pre-fabricated plug in cables. All alarm contacts located within a panel shall be wired to terminal blocks. Thermocouple and other special circuits shall be field wires direct to instrument terminal blocks without the use of panel wiring.

All control and instrument wiring used within the panels shall confirm to NEC and NEMA standards and shall be factory installed and tested at the works of a qualified manufacturer. All interior wiring shall be installed neatly and carefully, and shall be terminated at suitable terminal blocks. Sufficient clearance shall be provided for all control and instrumentation leads, and all incoming and outgoing leads shall be connected to terminal blocks suitably located for connecting external circuits.

All panel wiring shall have appropriate ferruling for clear identification. Interior wiring shall be so arranged that the external connections can be made with only one wire per terminal point. Any common connections shall be made internal side of the terminal blocks. Common connections shall be limited to two wires per terminal. Instrumentation cable shield wires shall be connected to separate terminal at the terminal block. Signal circuit shields shall be grounded separately.

All internal wiring (except low level instrument wiring) shall be National Electric Code Type SIS, Plyometric / Elastomeric insulated, tinned copper stranded conductor, switchboard wire, or owner approved equal.

Panel wiring shall have a flame resistant insulation with adequately sized 650 / 1100 V grade tinned copper stranded conductor based on current carrying capacities as etc. forth by the National Electric Code. Wire sizes shall be as specified herein and suitable for intended applications.

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

Wiring shall be arranged to enable instruments or devices to be removed and / or serviced without unduly disturbing the wiring. No wire shall be routed cross 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.

Panel wires shall be identified with wire number and each termination by means of action craft products split sleeve or Borden Chemical Co. indelible tubing markers or owner approved equal. Corrections and modifications of all panel wiring shall be Bidder's sole

responsibility. Any corrections / modifications required at site for successful commissioning shall be done by the Bidder without any additional costs. Terminal lugs furnished must be of the compression, insulated sleeve, half ring tongue type. Open ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs. Wires shall not be tapped or spliced between terminal points.

Panels, cabinets, consoles / desks will be provided with removable, gasketed cable gland plates and cable glands, for all floor slots used for cable entrance. Split type grommets shall be used for prefab cables.

Internal wiring in factory prewired electronic systems cabinets may be installed according to the Bidder's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring power supply wiring, and interconnecting cables between devices shall pass the following tests.

- 1) Flammability test IEEE 383 / 1974
- 2) When tested under UITPP test method or ASTM 2893 / 77 light transmittance of 80%.
- 3) When tested under IEC 754-1 maximum acid gas generation shall be 2% by weight
- 4) Oxygen index not less than 30 as per ASTM D 2863.

All terminations for intra panel wiring inter panel cabling and connecting the Bidders panels, PB stations, control stations etc. shall be with cage clamp Screwed less connections. Soldered connections are not acceptable. All field side or external input connections shall also preferably of Cage clamp / Spring Clamp / Screwed less connection.

Conductor clamping shall also confirm to Standard IEC – 60947-1 & IEC-60947-7-1. Identification of conductors may be done by insulation colour coding identified on drawings or by printed wiring lists. Terminal blocks for connection of external circuits in to factory prewired electronic system cabinets shall meet all the requirements as described elsewhere in the specification. For all multicore cables, the outer sheath shall satisfy the properties identified above. However, for panel wiring, the wiring insulation shall also satisfy the properties identified above. The internal wiring shall be done in coloured wiring.

Following Wire size shall be utilized for internal wiring:

S.No	Nature of signals	Wire size
1	Current (4-20 mA), Low voltage signals (AI / AO & DI signals)	0.75 sq.mm
2	DO signals, Ammeter / voltmeter circuit, control switches, indicator, recorder	1.5 sq.mm
3	Internal Illumination	2.5 sq.mm

S.No	Nature of signals	Wire size
4	Size of Power supply cables shall be as below:- i. 1 to 16 Amp. ii. 17 to 20 Amp. iii. 21 to 32 Amp. iv. 33 to 40 Amp. v. 41 to 60 Amp. vi. Power earth	2.5 sq. mm 4 sq. mm 6 sq. mm 10 sq. mm. 16 sq. mm 4 sq. mm

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-423-154A-A001

d) Instruments Mounting

Instruments and relays mounted on the panels shall be easily accessible for repair and replacement without disturbing other equipment their connected wiring. No special tools shall be needed for the purpose.

e) Panel Illumination

Panels shall be provided with LED based illuminating lamps with door switch and six (6) point 6 / 16A, 240V AC universal type power sockets with switch for maintenance purposes. These switches shall be with quick make and break mechanism. 100 % spare LED lamps shall be provided with each panel, these are in additional to mandatory spares.

f) Fuse Blocks

Where fuse blocks rated 30 amp. 250 Volts are required by the specifications or the manufacturer's design, they shall be modular type with Bakelite frame and reinforced retaining clips. Blocks shall be class H.2 pole, screw terminal fuse blocks. Blocks for other current and voltage ratings shall be similar in construction.

g) Fuses & MCB

All fuses shall be fast acting semiconductor types for AC supply and compatible to the UPS fuses. For all DC Powered devices, similarly the fuses shall be fast acting compatible to

DCDB fuse provisions. All the AC power supplies shall be provided with the protection of Fast acting semiconductor fuses & 2 P thermomagnetic type MCB. Make of Fuses shall be GE or Siemens. For all the DC power supply circuits, electronic type DC MCB shall be used only. Make of DC MCB shall be Siemens, Phoenix contacts, Murr, Weidmuller, or Lutze. 50 % spare fuses shall be provided with each panel, these are in additional to mandatory spares.

h) Moulded Case Circuit Breakers

Moulded case circuit breakers used in equipment covered under these specifications shall have not less than 5000 amp. Interrupting capacity at 220 Volts DC 10,000 Amp. Symmetrical interrupting capacity at 240 Volts AC. MCCB shall be provided at each main feeder line like ACDB & DCDB main feeders, PLC main feeder, control panels, UPS circuits etc.

i) Grounding

All panels and cabinets shall be provided with a continuous bare copper ground bus of minimum 6 mm x 25 / 50 mm cross section. The ground bus shall be bolted to the panel structure and effectively ground the entire structure. Each Ground bus shall have provision at each end for connection of ground leaks (6 mm x 50 mm GI Flats) by suitable bolting. All system cabinets shall be brought to a common system ground by the bidder. Electronic earthing resistance shall be < 0.5 ohms.

Each circuit requiring grounding shall be individually and directly connected to the panel ground bus by ring tongue type compression lugs. For electronic system cabinets the system ground bus shall be insulated from the cabinet enclosure and shall be separately connected to the system ground. All system cabinets shall be brought to a common system ground by the bidder.

The Bidder shall furnish his recommendations regarding grounding requirements for all equipment / systems and shall specifically indicate the deviations if any from the above requirements as a part of his proposal.

j) Terminal Blocks

For all inputs to the system emanating from the field or other systems, the bidder shall furnish terminals suitable for correct size of field cables.

All outputs going to MCC / SWGR terminal blocks, shall be rated 600 volts minimum and shall have strap screw less terminals suitable for connection of wires with ring tongue type lugs. Standard terminal blocks shall be screw less cage clamps type. Terminal blocks shall be approximately sized for larger wire size of higher voltage insulated incoming conductors as necessary. All the TBs used shall be 6.6 polyamide to withstand corrosion and the metallic portion shall be coated against rust / corrosion. All metal parts should be nonferrous in nature.

Terminal blocks shall be provided with white marking strips and re permitted by the safety codes and standards shall be without covers.

Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable.

At least 20 per cent spare unused fully wired terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable with each panel, enclosure, cubicle, SOV Boxes etc.

k) Name Plates and Labels

Name plates of adequate size shall be provided for each panel on front and rear of the panel. Instruments / other accessories mounted inside the panels shall have identification marking clearly visible from inside.

Devices to be mounted on the panels shall also be labelled on the panels shall also be labelled on the outside of the panel. Name plates shall be of polyamide sheets with black letters on white background. Name plates shall be attached to the boards by means of stainless steel pan head screws. Fuses provided for protection of various boxes shall be accessible for replacement. Fuse boxes shall be provided with circuit label and fuse rated current and voltage.

l) Markings / Labels

All markers / labels shall be made of halogen & silicon free polyamide material with inflammability class V2 as per UL 94, ensuring scratch proof printing with the use of environment friendly solvent free ink & latest BLUEMARK UV technology so as to comply the WIPE RESISTANCE according to DIN EN 61010-1 / VDE 0411-1.

2.3.6.6 Local Instrument Racks & Enclosure

Transmitters and switches located in the field shall be grouped together and shall be installed in the enclosure (closed transmitter racks) in case of outdoor area such as Boiler area etc. And in open type Rack in case of covered area. Racks shall be factory prefabricated & painted and complete with internal tubing, manifold valve, isolation valves, integral junction boxes with outside access door, illumination etc. Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging.

i) Closed Type Instruments / Transmitter Racks

- a)** Required number of Instruments / transmitter racks shall be furnished to house transmitters, switches and converters by grouping them suitably, area wise / function-wise.
- b)** The transmitter enclosure shall be constructed of 3 mm thick steel plate. The enclosures shall preferably be of modular construction and with two end plate assembly bolted to the frame.
- c)** The enclosure shall approximately be 1200 millimetres wide, 1000 millimetres deep and 2200 millimetres high to allow easy access to the internals. Racks shall be reinforced as required to ensure true surfaces and to provide adequate support for instruments and equipment mounted therein. Double interlocking doors with three point locking arrangement shall be provided and shall be arranged for maximum possible access to the interior. Centre posts or any member which would reduce access shall not be provided.

- b) Since nowadays the reliability and availability of control system is enhanced due to the redundancy path, backup panel with mosaic and vertical type (not L type) is to be provided with as minimum as possible for safe guarding the main equipments BTG and auxiliaries.
- c) **Hence** in addition to the LVS and OWS, a limited operation from backup unit control vertical panel with mosaic is envisaged for emergency operation and to provide safe shut down of plant/equipments. The backup Unit control vertical panel with mosaic shall be housed Conventional Push-button (ILPB) stations, Console inserts (SG & TG), Trip Push Buttons, Ammeters, CCTV for Furnace Flame, chartless recorders & digital display units for Boiler, Turbine & Generator Process/electrical parameters. Also bidder to refer details in Chapter 6.
- d) Back up panel system shall be designed for handling the situation in clause 2.3.2.17 for failure of HMI.
- e) For electrical layout, complete backup panel with mosaic shall have to be provided for complete on/off operations with necessary meters, DDU's, synchroscope etc. as specified elsewhere in specification.

2.3.2.11.1 Unit Control And Monitoring Philosophy

The main equipments namely SG & Auxiliaries, TG & auxiliaries, Power cycle / LP piping, Equipments cooling area system and Circulating water system CW etc for this project is envisaged to be controlled from the operator workstations (OWS) mounted on the Unit control Desk (UCD) in association with Large Video Screens (LVS) and backup panels in the Unit Control Room (UCR) under all regimes of operation i.e. start up, shutdown, load maneuvering, load throw off & emergency handling. All the information required for safe and efficient operation of the plant shall be displayed on OWS MONITORS at high speed and accuracy in specially designed displays suitable for Power plant operation. The quantity of OWS stations and LVS are shown in the configuration diagram and elsewhere in the specification.

It may be noted that the plant operation in all regimes even in case of emergency operation is envisaged through LVS and OWS MONITOR only. However Hardwired PB Stations / TPL switches and supervisory/monitoring instruments are envisaged for utmost emergency or the contingency and in case non availability of both i.e. operators' workstations & LVS so as to bring the unit or equipment to safe shutdown without damaging plant/equipment.

Control panel cum desk with HW annunciation windows, ILPBs, Ammeters, PBs, voltmeters, indicators, mimic, recorders etc. shall be provided as Control System Philosophy.

2.3.2.12 **Protection, class of cabinets / panels, enclosures etc.**

- a) All panels, desks cabinets, consoles & enclosures furnished at least comply with the requirements of protection classes as indicated below.

Ambient Temperature (outside cabinets)	Atmosphere & Pressure	Relative Humidity (RH)	Required Protection Class
Outdoor Locations			
55 degree C max.	Dirty Air @ Atmospheric Pressure	100 % Max.	IP 66***
4 degree C min.	Dirty Air @ Atmospheric Pressure	5 % Min.	IP 66***
Indoor Locations			
55 degree C max.	Air @ Atmospheric Pressure	95 % Max.	IP 54**
4 degree C min.	Air @ Atmospheric Pressure	5 % Min.	IP 54**
Air Conditioned Areas			
24±5 degree C (normal)	Air @ Atmospheric Pressure	95 % Max.	IP 32
50 degree C max.*	Air @ Atmospheric Pressure	5 % Min.	IP 32
* During air conditioning failure.			
** For non-ventilated enclosures. For ventilated enclosures, protection class shall be IP 42.			
*** With a suitable canopy at the top to prevent ingress of dripping water.			

- b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 65.
- c) The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.
- d) The panels housing electronic hardware shall be provided with flame and smoke detectors by bidder.
- e) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturb to the working personnel.
- f) For Hazardous areas the protection class shall be in accordance with the requirements of the relevant NEC code for the location.
- g) ~~Workstations, OWS, EWS, Servers, Network Switches, Printers, and other peripherals, maximum temperature limit shall be 40 deg. C. For LVS the same shall be around 30 deg. C.~~
- h) ~~For remote I/O cabinets mounted in non-AC areas, panel redundant AC shall be provided.~~
- i) Specific requirements due to corrosive applications and corrosive environment at project site shall also be considered by bidder.
- j) Delivery of all electronic panels from the manufacturer's works are subject to readiness of respective work fronts or readiness of fully covered stores.

Guards, barriers and access doors, covers of plates shall be marked to indicate the hazard, which may occur upon removal of such devices. Danger or caution signs shall be used to warn of specific hazards such as voltage or current. The marking shall be permanently affixed to the equipment.

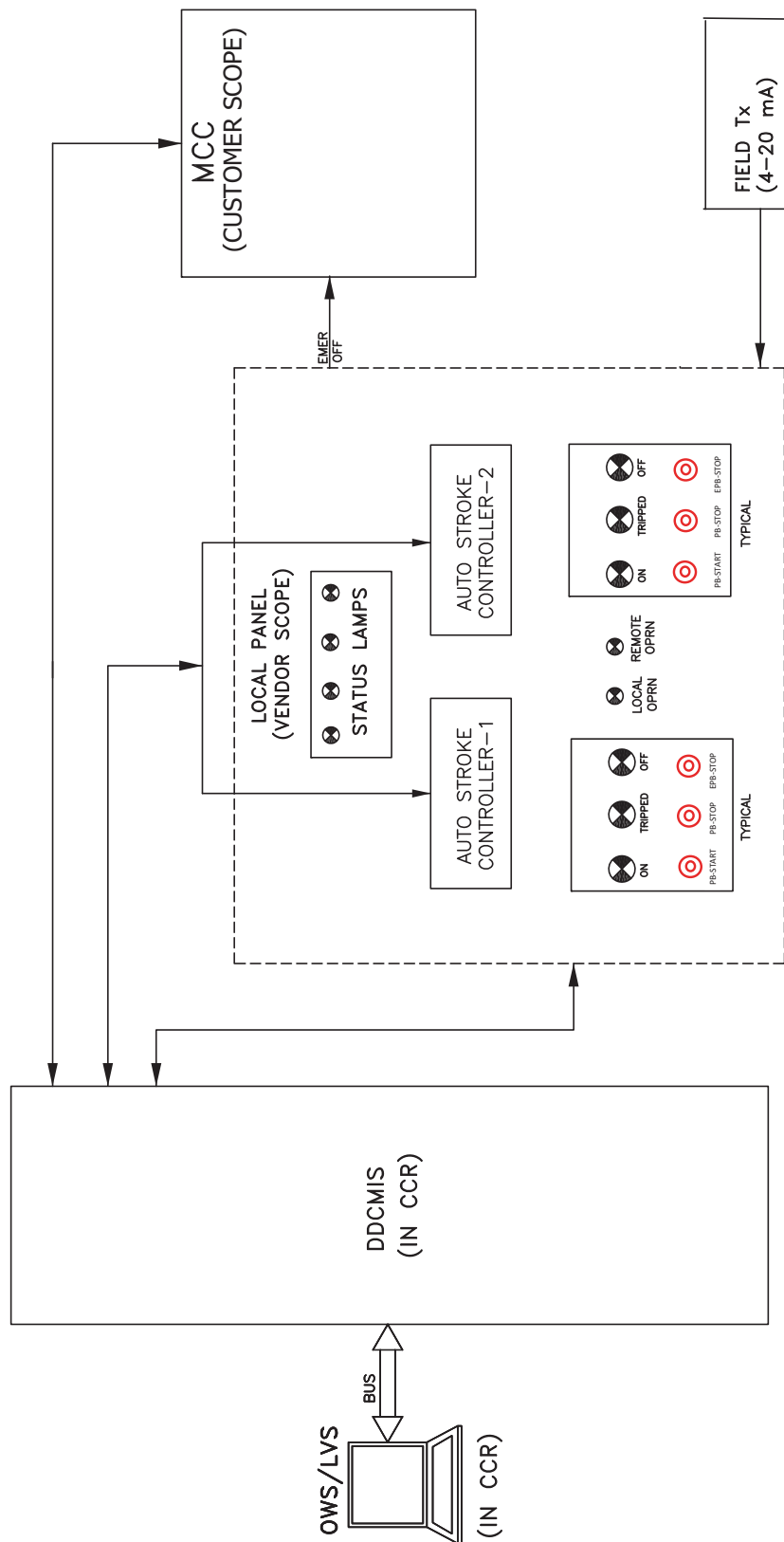
2.3.2.13 System Documentation

Master document/drawing list along with dates within 3 months shall be submitted by bidder after award of contract for each package for approval of owner. The Bidder shall provide drawings, system overview & description, hardware/software details, Technical literature, functional & hardware schemes, bill of material, parts list, Inter connection diagrams, data sheets, erection / installation / commissioning procedures, Instruction/operating manuals, etc. for each of the C&I system/sub-systems/equipment, supplied under this package. The documentation shall include complete details of the C&I systems/sub-systems/equipment to enable review & approval by owner during detailed engineering stage and to provide information to plant personnel for Operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/sub- Systems/equipments at site. Following minimum documents shall be submitted by bidder during detailed engineering for review and approval:

DATA / DETAILS TO BE FURNISHED		
S.No	Description	Category
1	C&I System Design Basis Report incorporating Control philosophy / Operation philosophy / Design philosophy / Redundancy philosophy.	A
2	Codes and application standard followed for the project.	A
3	Process & Instrumentation Diagrams (PID) indicating local gauges, Transmitters, analysers for (alarm, control etc.)	A
4	Engineering documents for DDCMIS / DCS based control systems: a. Bill of Quantity for DDCMIS / DCS based system b. I / O Assignment for DDCMIS / DCS based control system including nest loading. c. Instrument Schedule with set points d. I / O List e. Drive List / Solenoid Valve List f. Annunciation List g. SOE list. h. Process mimics / graphics indicating Analog and digital parameters i. List of logs with point assignment j. Time Synchronisation System k. Historical Storage and Retrieval (HSR) system details. l. List of Displays m. Plant Performance Calculation & Optimisation package Details n. Controller partitioning Diagram o. Data sheet for HART management system p. Drive Control Philosophy & MCC Interface diagrams	A

BLOCK INTERFACE DIAGRAM FOR CHEMICAL DOSING SYSTEM

BLOCK INTERFACE FOR CHEMICAL DOSING SYSTEM (TYPICAL)



NOTES:

1. SIGNAL EXCHANGE BETWEEN DDCMIS & CHEMICAL DOSING LOCAL PANEL BE AS PER CONTROL PHILOSOPHY.
2. FIELD INSTRUMENT SHALL BE TERMINATED IN LOCAL PANEL.
3. SIGNALS FOR INTERFACE TO/FROM DDCMIS ARE ALSO TERMINATED IN LOCAL PANEL.
4. THE LOCAL PANEL IS TYPICAL. SIMILAR PANELS SHALL BE APPLICABLE FOR
 - A. AMMONIA DOSING SYSTEM
 - B. NaOH DOSING SYSTEM
5. AUTO STROKE CONTROLLER SHALL HAVE FACILITY OF STROKE LENGTH ADJUSTMENT THROUGH PUSH BUTTONS & 4-20mA SIGNALS.

	1X800MW TANGEDCO NORTH CHENNAI TPS		DRG.NO.	PE-DG-999-145-1273A
	TITLE STANDARD BLOCK INTERFACE DIAGRAM FOR CHEMICAL DOSING SYSTEM		DATE	
			REV.NO.	01
		SHT		

ACTUATORS

|

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-ID-423-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 05.10.16
			SHEET 1	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	1x 800 MW NORTH CHENNAI PROJECT		
	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, WEATHER PROOF, IP:68		
	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 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 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 (BIDDER TO CONFIRM) A: ☒ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	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		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-ID-423-145-I902				
			VOLUME II B				
			SECTION D				
			REV. NO. 00	DATE: 05.10.16			
			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)			
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 68 ☐ FLAME PROOF					
	@ 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	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED					
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS					
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)					
	IF SMART						
	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 or OFF MODE/STOP PB OPTD, TORQUE SWITCH OPTD. MID WAY/MOTOR THERMOSTAT TRIP)						
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.: PE-ID-423-145-I902		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	00	DATE: 05.10.16
		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 (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☒ ELECTRONIC (2 WIRE) R/I CONVERTER ☐ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ 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: suitable for 3Cx2.5sq mm for motor rating 3.7 kW, 3Cx10 sq mm fr motor from 3.7 kW to 5.5 kW.	
	@ SPACE HEATER CABLE GLAND	SIZE:- Space heater cable gland to be derived internally.	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP (Cable size 2Px1.5mm ²)	
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :----- (8Px0.5 sq mm)-----	
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 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.

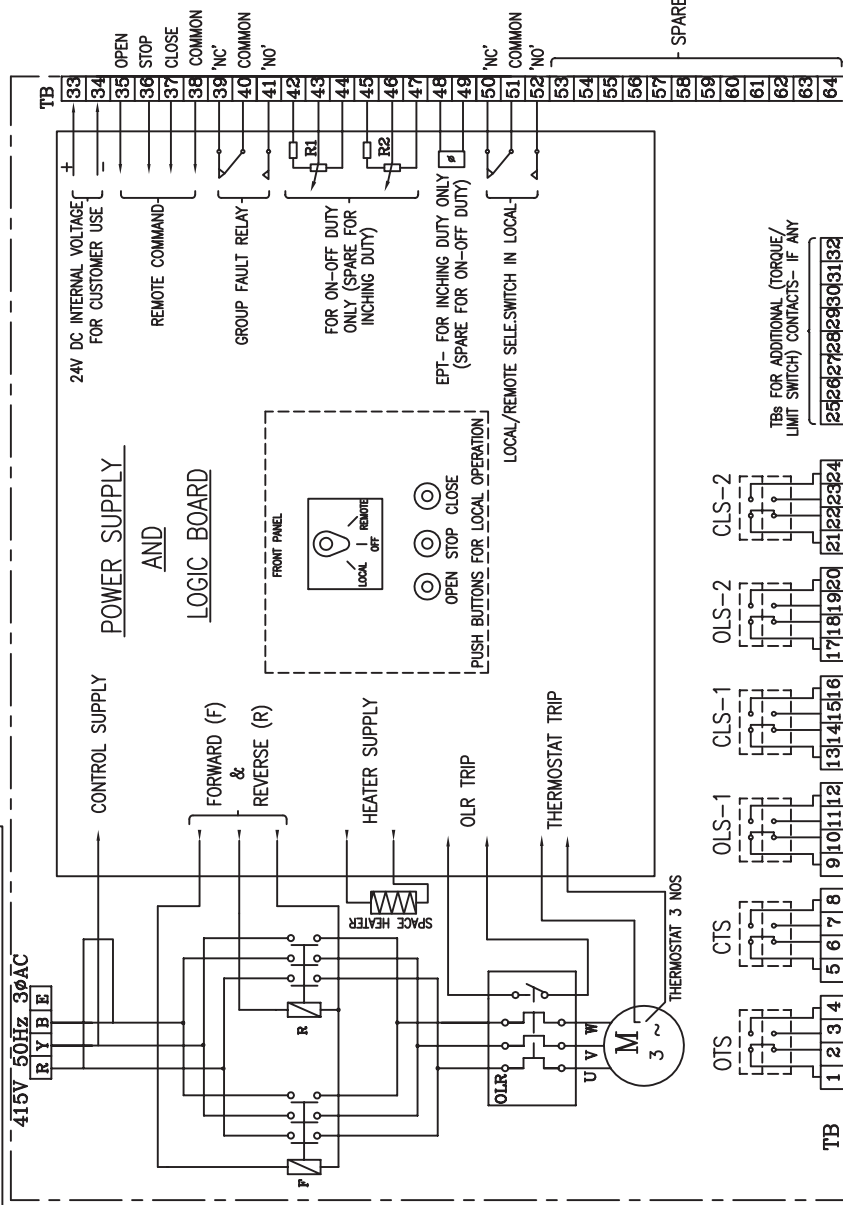
\$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
	SEEMA KHATRI	SURESH CHAND SHARMA	SURESH CHAND SHARMA	NAME
				SIGNATURE
	05.10.2016	05.10.2016	05.10.2016	DATE

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES

DRAWING NO. 3-V-MISC-24227



NOTE:—

- | | | | |
|--|-----|------|------------|
| | REV | DATE | ALTERED |
| | | | CHD & APPD |
- 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
 - CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
 - OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
 - OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
 - CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
 - EPT - ELECTRONIC POSITION TRANSMITTER
- (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
 - FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
 - M - MOTOR 3 ϕ 415V 50 Hz AC SUPPLY

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 the interest of the company.

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

**TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT**

		BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TRICHURAPALLI-620014.		DRN	NAME N.P.ESWAR	SGN N.P	DATE 07.10.04	NO. OF VAR.
				CHD	D.DINAKARAN	D.D	07.10.04	
365-121				APPD	K.ARUNACHALAM	K.A	07.10.04	
DEPT		SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS				

WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER	CARD CODE U 01
--	----------------------

DRAWING NO.

3-V-MISC-24227

Page 341 of 363

Size A3



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

2.2.13 ACTUATORS

2.2.13.1 SCOPE

This Specification covers the general requirements of Electric Motor Actuators for valves, dampers and gates.

All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification.

2.2.13.2 CODES & STANDARDS

All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below except where modified and / or supplemented by this specification.

Code	Name of standard
IS: 325	Specification for three phase induction motor
IS: 900	Code of Practice for installation and maintenance of induction motors.
IS: 996	Single Phase AC Motor
IS: 1271	Thermal evaluation and classification of electrical insulation.
IS:2223	Dimensions of flange mounted AC induction motors.
IS: 3043	Code of practice for earthing
IS: 4029	Guide for testing three phase induction motors.
IS: 4691	Degree of protection for enclosures of rotating electrical machinery.
IS: 4722	Specification for rotating electrical machinery.
IS: 4728	Terminal marking and direction of rotation for rotating electrical machinery.
IS: 4889	Methods of determination of efficiency of rotating electrical machines.
IS: 5571	Guide for selection of electrical equipment for hazardous areas.
IS:6362	Designation of Method of Cooling of Rotating electrical machines.
IS: 8789	Values of performance characteristics for three phase



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

	induction motors.
IS: 9334	Electrical Motor Operated Actuators
IS: 12065	Noise level of motors.
IS: 12075	Measurement and evaluation of vibration of rotating electrical machines.
IS: 12615	Induction motors-Energy efficient, three-phase, squirrel cage – Specification
IS: 12802	Temperature rise measurement of rotating electrical machines.
IS: 12824	Type of duty and classes of rating assigned.
IEC: 60034-1	Rotating electrical machines
NEMA, MG-1	Motors and Generators

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be furnished during detail engineering.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

2.2.13.3 General

- a) The Actuators shall be integral starters along with overload relays with built in SPP (Single Phase Preventer) with provision for operation from Control room, Local and by wireless set.
- b) The actuator motors shall be suitable for use on 415 Volt 3 phase 50Hz power supply. The actuator comprising motor, integral reversing starter, local control facilities and terminals for remote control and indication shall be housed within a self contained, sealed enclosure.
- c) Actuator working platforms shall be provided for maintenance purpose.
- d) Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage/authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent access to the commissioning tool.
- e) For some specific applications, integral starter shall also be separately mountable



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

casting type and plug-in. Such applications shall be decided during detail engineering.

2.2.13.4 Actuator Sizing

The actuator shall be sized to guarantee valve closure at the specified differential pressure. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall be such as to give valve closing and opening at approximately 4 to 5 mm per second unless otherwise stated in the job specification. Transient voltage dip on starting of the largest motor with DOL shall be limited to 20% of the nominal system voltage at the voltage terminals.

2.2.13.5 Environmental

Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from 10°C to 50°C, upto 95% relative humidity. Actuators for explosion-hazardous applications shall in addition be certified Flameproof for Zones 1 and 2 (Divisions 1 and 2 Group gases).

2.2.13.6 Enclosure

Actuators shall be 'O' ring sealed, watertight to IP68 degree of protection. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed at site for cabling.

2.2.13.7 SPECIFIC REQUIREMENT

- i) The actuator shall essentially comprise the drive motor, torque/ Position limit switches, gear train, clutch, hand wheel, position indicator and transmitter, inbuilt thermostat for overload protection, space heater and internal wiring. Actuator shall be integral type. Integral starters shall have facility to hook-up with plant DCS for positioning of limit and torque switches.
- ii) The actuator enclosure shall be totally enclosed, dust tight, weather proof (NEMA-6/IP-68) suitable for outdoor use without necessity of any canopy.
- iii) All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- iv) The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.
- v) A lockable local/remote selector switch shall also be provided for selecting mode of operation.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- vi) Gear Train:-Metal (Fibre gears are not acceptable) self-locking to prevent drift under torque switch (where ever applicable) spring pressure when motor is de-energised.
- vii) Manual Wheel:- Shall disengage automatically during motor operation.
- viii) Duty cycle of actuators shall suit the system requirement. The actuators shall be capable of giving the required torque at the output shaft. The actuators shall be designed to take the full thrust
- ix) The integral starter which shall have sophisticated electronic controls with field programming feature. It shall be designed for remote control from DCS/Respective control system. Required interposing relays for receiving open/close/stop command from DCS/Respective control system shall be provided. Potential free contacts and transducers shall be provided to provide status indication at remote DCS/Respective control system.
- x) A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.
- xi) The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.
- xii) The following individual status annunciation LED's (Colour-Green) shall be provided locally (Integral to actuator) to annunciate the following for easy local monitoring.
 1. Actuator in local mode
 2. Actuator in remote mode
 3. Actuator running in OPEN direction
 4. Actuator running in CLOSE direction
 5. Actuator in inching mode.
 6. Actuator in self-retaining mode
 7. Limit switch OPEN trip
 8. Limit switch CLOSE trip
 9. Control voltage availability
- xiii) The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)
 1. Torque switch OPEN
 2. Torque switch CLOSE
 3. Thermo switch trip
 4. Electronic overload relay trip
 5. Motor single phasing
 6. Common fault (Inclusive of any one or combination of above fault)



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- xiv) View port shall be provided on integral starter unit to monitor the above status annunciation and fault annunciation.
- xv) Electronic overload relay shall be provided to trip actuator in case of overload. Plug in connections/design shall be provided between:-
 1. Integral starter unit and basic actuator
 2. Between external customer connections and actuator
- xvi) OPEN-CLOSE indication /LED shall be provided for indication of full open/close position.
- xvii) Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.

2.2.13.8 Motor

The electric motor shall be Class F insulated, with a time rating of at least 15 minutes at 50°C or twice the valve stroking time, whichever is more, at an average load of at least 33% of maximum valve torque.

- i) The squirrel cage induction motor shall be designed for full voltage direct-on-line start, with starting current limited to 6 times full-load current. The motor shall be capable of starting at 85% of rated voltage and running at 80% of rated voltage at rated torque and also at 85% of rated voltage at 33% excess rated torque for a period of 5 minutes each. The motors shall otherwise generally conform with technical specification for motors mentioned elsewhere in this specification.
- ii) The actuators shall be sized so as to open or close valves/ dampers at rated speed enclosure shall not be more than 70 degree 'C' over ambient temp. of 70 deg.C as these are subjected to higher ambient conditions due to their vicinity to operate fluid on continuous load operation. The actuators shall be suitable for a relative humidity of 95%. Class of insulation shall be class-F and type of enclosure shall be IP-615.0
- iii) Insulation:- The motor winding shall be insulated with class-F insulation having temperature rise limited to Class-B.
- iv) Performance:-The motor shall be capable of:
 - a) Starting at 85% of rated voltage
 - b) Running at 80% of rated voltage at rated torque for 5 minutes
 - c) Running at 85% rated voltage at 33% excess rated torque for 5 minutes.
- v) Maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

Vi) Bearing

The motor bearing shall be double shielded, grease lubricated and antifriction type.

vii) Earthing

At least two earthing terminals shall be provided for the motor body. Separate earthing terminal should be provided for terminal box.

2.2.13.9 Motor Protection

Protection shall be provided for the motor as follows:

- i. The motor shall be de-energized in the event of a stall when attempting to unseat a jammed valve.
- ii. Motor temperature shall be sensed by a thermostat de-energising the motor in case of overheating.
- iii. Lost phase protection.
- iv. Overload protection.
- v. Short circuit protection by suitably rated long acting fuse.

2.2.13.10 Gearing

The actuator gearing shall be totally enclosed in an oil-filled gear casing suitable for operation at any angle. All drive gearing and components must be of metal construction and incorporate a lost-motion hammer blow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gear casing for inspection or disassembling without releasing the stem thrust or taking the valve out of service.

2.2.13.11 Hand Operation

A hand wheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to power automatically by starting the motor. The hand wheel or selection lever shall not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.

The hand wheel drive must be mechanically independent of the motor drive and any hand wheel gearing should be such as to permit emergency manual operation in a



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

reasonable time. Clockwise operation of the hand wheel shall give closing movement of the valve unless otherwise stated in the job specification.

2.2.13.12 Drive Bushing

The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base should be of the sealed for life type.

2.2.13.13 Limit Switches

- a) Each motor actuator shall have Six (6) rotary drum position limit switches with two for open each with 2 NO + 2NC contacts and two for close each with 2 NO + 2 NC contacts positions, each with adjustable setting between fully open and fully closed positions. Each rotary drum limit switch shall have two (2) limit switches for intermediate open position each with 2 NO + 2 NC contacts. The limit switches shall have capacity of 5A at 240V AC or 0.5A at 220V DC.
- b) Each motor actuator shall also have two (2) torque limit switches with two (2) normally opened and two (2) normally closed contacts each.
- c) The torque switches shall have a minimum accuracy of 3% of set value. The torque switches shall be provided with calibrated knobs for setting desired torque and separate knobs shall be provided for open and close torque switches. The torque and position limit switches shall be housed in a separate enclosure with protection class as that of actuator.
- d) The motor operators/actuators shall be capable of meeting 150 percent of unseating torque at specified voltage.
- e) The motor actuators shall have 2 nos. potentiometric type transmitters of 100 ohm rating.
- f) Torque switches shall function to stop the motor on closing/opening. Upon actuation by the torque clutch it is restricted its attempt to open or close, thereby causing an overloading torque. Torque switches shall be self-resetting type only (i.e.) once a particular direction torque switch operates, it shall get resetted only when the equipment is operated in other direction.
- g) All six (6) limit switches shall be changeover type and adjustable besides having the snap facility. All limit switches, contacts shall be wired up independently upto the terminal block.

2.2.13.14 Remote Valve Position/Actuator Status Indication



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iv. Four contacts shall be provided which can be selected to indicate any position of the valve. Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during hand wheel operation when all external power to the actuator is isolated.
- v. The contacts shall be rated at 5A for 240V AC, 0.5A for 220V DC.
- vi. As an alternative to providing valve position any of the four above contacts shall be selectable to signal one of the following:
 - a. Valve opening, closing or moving
 - b. Thermostat tripped, lost phase
 - c. Motor tripped on torque in mid travel, motor stalled
 - d. Remote selected
 - e. Actuator being operated by hand wheel
- vii. Position feedback has to be provided for all inching type applications. These shall be interfaced with plant DDCMIS.
- viii. Actuator local and remote indications shall be grouped and taken separately

2.2.13.15 Local Position Indication

The actuator shall include a digital position indicator with a display from fully open to fully close in 1% increments. Red, green and yellow lights corresponding to open closed and intermediate position shall be included on the indicator. End of travel indication colours shall be reversible. The digital display shall be maintained and updated during handwheel operation when all external power to the actuator is isolated. The display shall incorporate valve, actuator and control status indication. Provision shall be made to orientate the display through increments of 90°.

Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analogue signal corresponding to valve travel for remote indication when required.

2.2.13.16 Integral Starter and Transformer

The reversing starter, control transformer and local controls shall be integral with the valve actuator suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size. The starter logic shall be microprocessor-based. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tappings and be adequately rated to provide power for the following functions:



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- i. Energization of the contactor coils.
- ii. DC output where required for remote controls.
- iii. Supply for all the internal electrical circuits.

2.2.13.17 Integral Local Control and Control Mode Selector

The actuator shall incorporate local controls for Open, Close and Stop and a local/ Stop/ Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.

The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

Provision shall be made to orientate the local controls through increments of 90°.

2.2.13.18 Control Facilities

- i. The necessary wiring and terminals shall be provided in the actuator for the following control functions:
- ii. Open and close external interlocks to inhibit local and remote valve opening and/or closing control. Provision shall be made to configure the interlocks to be active in remote control only.
- iii. Remote controls fed from an internal 24V DC supply and/or from an external supply rated 110V AC to be suitable for any one or more of the following methods of control:

Open, close and stop control :

- a. Open and close maintained or 'push to run' (inching) control
- b. Overriding Emergency Shut-down to Close (or Open) valve from a normally closed or open contact .
- iv. The following individual potential free relay contacts shall be provided in the actuator for remote annunciation to facilitate continuous monitoring of the actuator.
 - a. Actuator in local mode
 - b. Actuator in remote mode
 - c. Actuator (valve) running in OPEN direction.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- d. Actuator (valve) running in CLOSE direction.
 - e. Limit switch OPEN trip
 - f. Limit switch CLOSE trip
 - g. Actuator in local mode.
 - h. Actuator in inching mode.
 - i. Actuator in self-retaining mode.
 - j. Actuator power switched off /single phasing.
 - k. Torque switch trip, thermo switch trip and overload relay trip (or close)
- v. Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.
- vi. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of the contactor coils.

2.2.13.19 Monitoring Facilities

Facilities shall be provided for monitoring actuator operation and availability as follows:

- i. Monitor (availability) relay, having one changeover contact, the relay being energised from the control transformer only when the Local/Off/Remote selector is in the Remote position to indicate that the actuator is available for remote (control room) operation.
- ii. Where required, it shall be possible to provide indication of Thermostat trip and Remote selected as discreet signals. The actuator shall include a diagnostic module, which will store and enable download of historical actuator operation and torque data to permit analysis of actuator and valve in-service performance. Data download shall be carried out without removing any covers and all shall be available locally to the actuator or remotely via telecom data transfer.
- iii. Diagnostic and configuration software shall be made available in a Lap Top PC for user.

2.2.13.20 Wiring and Terminals

- i. Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end.
- ii. The terminals shall be embedded in a terminal block of high tracking resistance compound.



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BTG PACKAGE

- iii. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight sea land shall be provided with a minimum of 3 threaded cable entries with provision for a minimum of 4.
- iv. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.
- v. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:
 - a. Serial number
 - b. External voltage values
 - c. Wiring diagram number
 - d. Terminal layout
- vi. This must be suitable for the contractor to inscribe cable core identification along side terminal numbers.

2.2.13.21 Startup Kit

Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

2.2.13.22 Performance Test Certificate

- i. Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical valve load, and the following parameters should be recorded:
 - a. Current at maximum torque setting
 - b. Torque at max. torque setting
 - c. Flash test voltage
 - d. Actuator output speed or operating time
- ii. In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

2.2.13.23 The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

- a. Measurement of insulation resistance.
- b. Measurement of full load current.



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

c. Test running of the motors.

2.2.13.24 Drawing and Manuals

Following drawings/ data and Manuals to be submitted for approval:-

- i) Instruction manuals on Installation, tests
- ii) Actuator Data sheet.
- iii) Internal wiring diagram and control schematic.
- iv) Torque switch and Limit switch contact development.
- v) QAP for Test reports.
- vi) Manufacturers Catalogue
- vii) Instruction manuals on installation methods. tests etc.
- viii) Motor sizing calculation
- ix) Integral starter details
- x) General arrangement drawings
- xi) Test reports
- xii) Manufacturing quality plan
- xiii) Field quality plan

INSTRUMENT INSTALLATION DRAWING

|

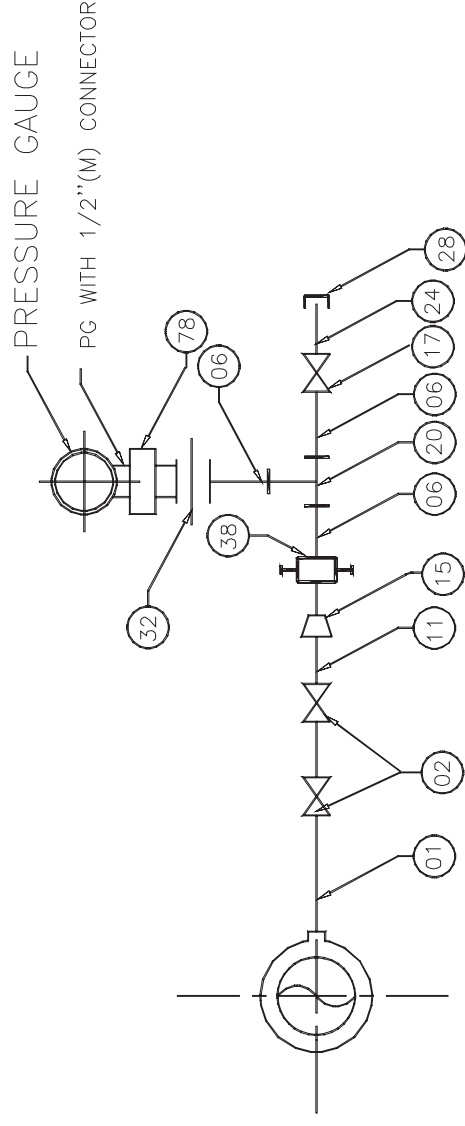


FIG-4 STEAM/LIQUID SERVICE

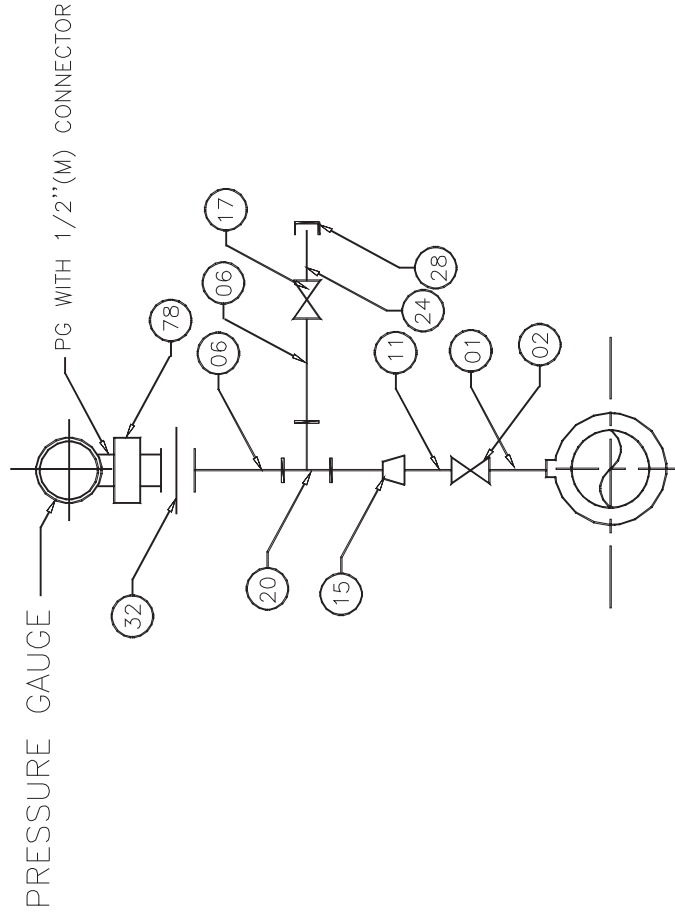


FIG-B AIR SERVICE

TAG NO.	DESCRIPTION	QTY.	
		A	B
78	1/2"NPT(F)X1/2"NPT(M) SNUBBER/ PULSATION DAMPER	1	1
38	3-WAY GAUGE VALVE WITH 1/2" NB SW	1	-
32	1/2"NPS, 3 PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED	1	1
28	1/2"NPT (f) CS CAP	1	1
24	1/2"NPS, SCH-80/160 X 1/2"NPT(M) CS/AS NIPPLE	1	1
20	1/2"SW EQUAL TEE, CS/AS	2	1
17	1/2"SW CS/AS GLOBE VALVE	1	1
1	1/2"/ 3/4"/ CS/AS NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PRE PROCESS REQ.)	AS REQ.	
15	1"TO 1/2"SW REDUCER	1	1
11	1"NPS SCH-80/160 CS/AS PIPE	1	1
6	1/2"NPS, SCH-80/160 CS/AS PIPE	AS REQ.	
2	1/2"/3/4"/1"ROOT VALVE - SW GLOBE VALVE	2	1

NOTE

REV	DATE	MECH	CIVIL	ELEC.	CH/FCD	DESCRIPTION
X	XX.XX.2015	XXX	XXX	XXX	XXX	PRELIMINARY ISSUE

**TAMIL NADU GENERATION AND DISTRIBUTION
CORPORATION LIMITED**

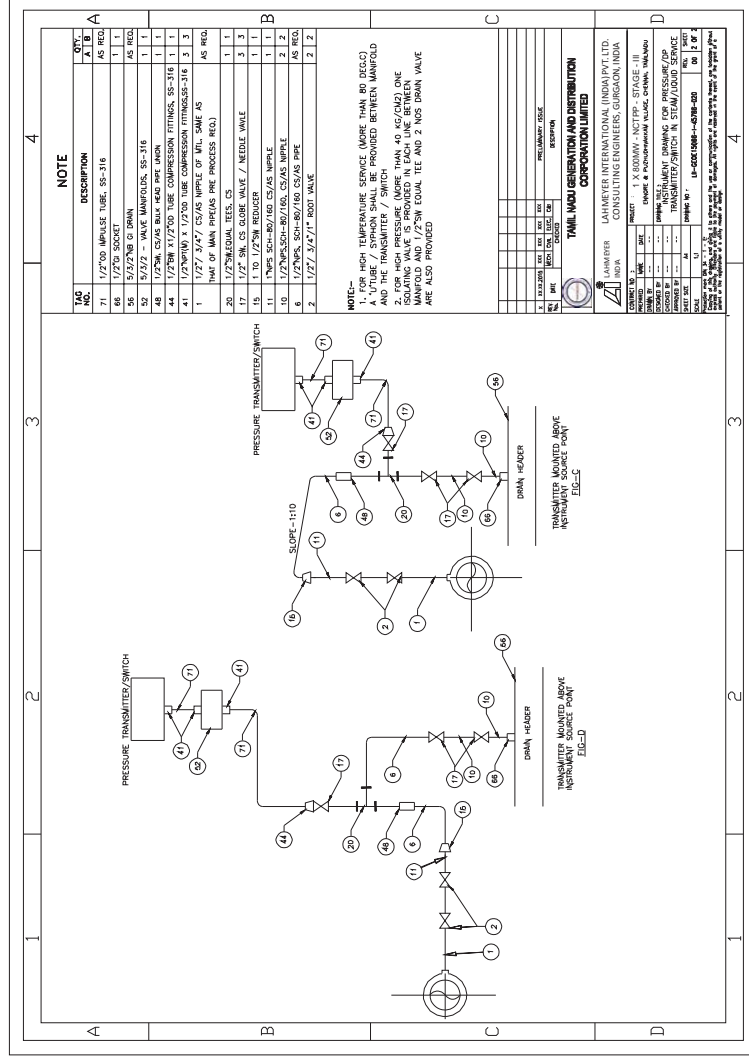
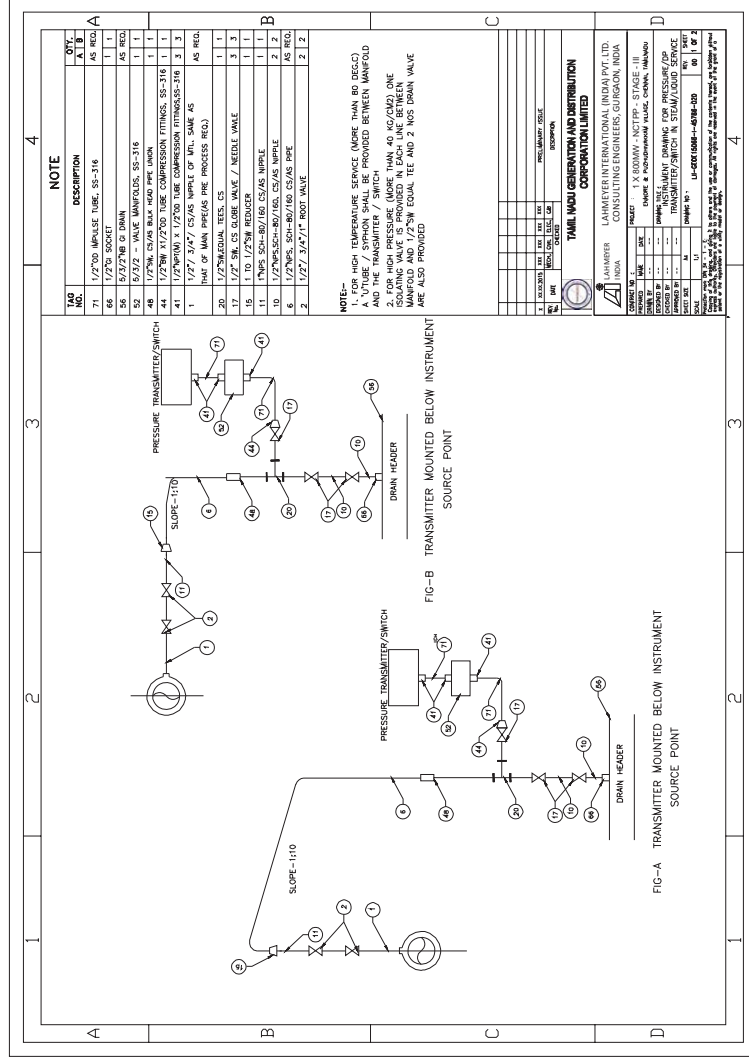
LAHMEYER
INDIA

LAHMEYER INTERNATIONAL (INDIA) PVT. LTD.
CONSULTING ENGINEERS, GURGAON, INDIA

CONTRACT NO :		PROJECT :		1 X 800MMW - NCTPP - STAGE - III	
PREPARED	NAME	DATE	ENDORE & PUZHODHIWAKAM VILLAGE, CHENNAI, TAMILNADU		
DRAWN BY	---	---			
DESIGNED BY	---	---	DRAWING TITLE :		
CHECKED BY	---	---	INSTRUMENT DRAWING FOR PRESSURE GAUGE		
APPROVED BY	---	---	FOR STEAM / LIQUID / AIR SERVICE		
SHEET SIZE	A4	DRAWING NO :	LII-GEDE/5066-I-45788-004		
SCALE		1:1	REV	SHEET	00 1 OF

Protection mark DIN 34 - 1 - E:

Copied of this drawings, and giving it to others and the use or communication of the contents thereof, are forbidden without the written permission of the drafter. All rights are reserved in this way of the grant of a utility model or design patent of the registration of a utility model or design patent.



NOTE

TAG NO.	DESCRIPTION	QTY.	
		A	B
81	1"X 2" CS EXPANDER, SW	1	1
76	SEAL DIAPHRAGM	1	1
75	2" 300 LBS ANSI FLANGE SUPPLIED ALONG WITH INSTRUMENT	1	1
74	2" 300 LBS ANSI FLANGE BOLT HOLES 8-190	1	1
70	INSTRUMENT CAPILARY TUBE SS 316	AS REQ	
11	1"NPS SCH-80/160 CS/AS NIPPLE	1	1
21	3/4EWUAL TEES, CS	1	1
1	1/2"/ 3/4"/ CS/AS NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PRE PROCESS REQ.)	AS REQ.	

NOTE:--

QTY. TO DOUBLED FOR DP MEASUREMENT

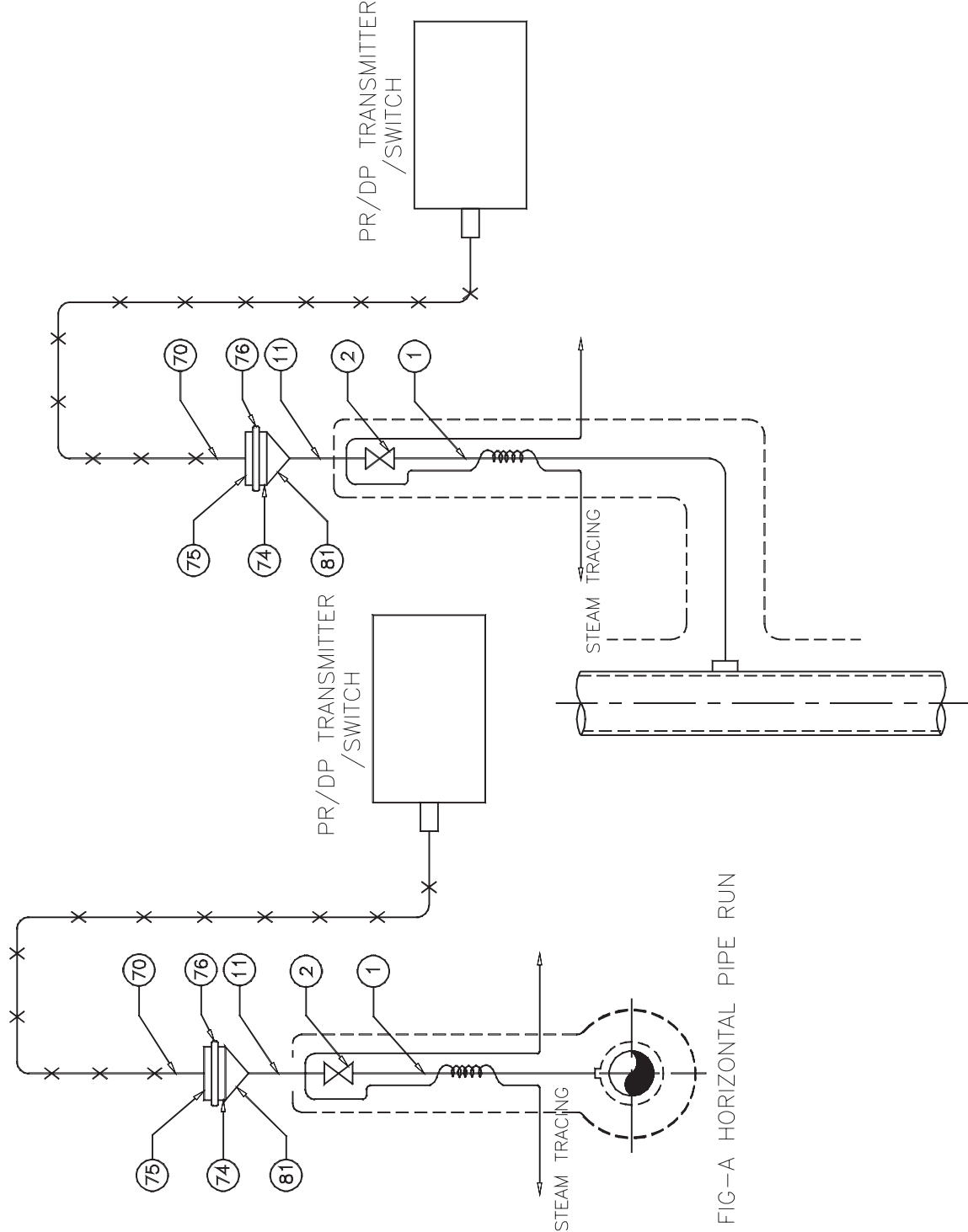


FIG-B VERTICAL PIPE RUN

FIG-A HORIZONTAL PIPE RUN

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

LAHMEYER INDIA		LAHMEYER INTERNATIONAL (INDIA) PVT. LTD. CONSULTING ENGINEERS, GURGAON, INDIA	
CONTRACT NO. :		PROJECT : 1 X 800MW - NCTPP - STAGE - III	
PREPARED :		NAME : ENNORE & PUZHUVIYAKKAM VILLAGE, CHENNAI, TAMILNADU	
DRAWN BY :		DATE : --	
DESIGNED BY :		--	
CHECKED BY :		DRAWING TITLE : INSTRUMENT DRAWING FOR PRESSURE/DP TRANSMITTER SWITCH IN OIL SERVICE	
APPROVED BY :		--	
SHEET SIZE :		DRAWING NO. : LI-GE015066-I-45786-025	
A4		REV. : 00	
SCALE :		1:1	
1:1		SHEET : 00	
1:1		OF : 01	
Protection mark (01, 02, ...) Protection mark (01,			

	TITLE:	SPECIFICATION NO. PE-TS-423-154A-A001
	1X800 MW COAL BASED NORTH CHENNAI TPP	SECTION III
	STAGE –III-BTG	SUB SECTION -
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE :
	CHEMICAL DOSING SYSTEM	

SECTION-III

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION III
		SUB SECTION -
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 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

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION III
		SUB SECTION -
		REV.NO. 0 DATE :

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL/Customer.
11. Prices for recommended spares (if any) for three year operation shall be furnished separately and not to be included in the base price.

	TITLE: 1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG	SPECIFICATION NO. PE-TS-423-154A-A001
		SECTION III
		SUB SECTION -
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE :

DECLARATIONS

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

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

Bidders Company Name

Authorized representative's
Signature

Name

Bidder's Name The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

DEVIATION SHEET (COST OF WITHDRAWAL)**1X800 MW COAL BASED NORTH CHENNAI TPP STAGE –III-BTG****TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM****TECH SPEC NO: PE-TS-423-154A-A001****TENDER ENQUIRY REFERENCE:-****NAME OF BIDDER:-**

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
-------	-----------------	----------	------------	--	-----------------------------------	---------------------------------	--	--	------------------------------

TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE

NOTES:

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