HARYANA POWER GENERATION CORPORATION LIMITED

RGTPP HISAR (2X600 MW)

PART - F

TECHNICAL DATA SHEETS

SECTION – VI

TECHNICAL SPECIFICATION

FOR

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

BIDDING DOCUMENT NO.: 31/CE/PLG/RGTPP/FGD-250

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TECHNICAL DATA SHEETS
FOR
FLUE GAS DESULPHURISATION (FGD)
SYSTEM PACKAGE

CHAPTER: I	**-**	**ESSENTIAL INPUT/INTERFACE DATA**
CHAPTER: II	**-**	**TECHNICAL INFORMATION TO BE SUBMITTED ALONG WITH THE BID**
CHAPTER: III	**-**	**TECHNICAL INFORMATION TO BE SUBMITTED AFTER AWARD OF CONTRACT**

CONTENTS

CHAPTER - I

ESSENTIAL INPUT / INTERFACE DATA

SUB-SECTION - DD0

GENERAL

CLAUSE NO.	BIDDER'S NAME
1.00.00	**ESSENTIAL INPUT/INTERFACE DATA TO BE PROVIDED BY THE BIDDER FOR EMPLOYER'S USE FOR DESIGN OF SYSTEMS IN EMPLOYER'S SCOPE. THIS DATA IS MANDATORY AND BIDDER SHALL SUBMIT THE REQUIRED DATA ALONG WITH THE BID.**
1.01.00	**INSTRUCTIONS TO BIDDERS**
1.01.01	**Bidder may note that Packages which are in the scope of Employer and where interface data is required from the FGD vendor. In order to facilitate detail engineering of awarded packages by Employer, the essential Input/Interface data as required for these packages need to be furnished along with the bid as a mandatory requirement as per the details indicated in this section of the Technical Data sheets.**
1.01.02	The Bidder shall ensure that all information, data, performance curves, technical literature (catalogues) and drawings furnished with the proposal fully describe all equipment/systems covered under this proposal and fully meet the requirements of the technical specifications.
1.01.03	The Bidder shall use one of the following responses while filling the questionnaire and proposal and fully meet the requirements of the technical specifications. a) The Section No. and Page No. of the proposal where the required information/data/ drawings have been furnished by the Bidder. b) An answer (data or narrative description or drawings). **NOTE**: The use of responses such as **"WILL BE FURNISHED LATER ON"** are not allowed.
1.01.04	The Employer reserves the right to ask for further details regarding technical features, application particulars, performance, past experience for similar applications or any other information as may be required to fully satisfy himself regarding suitability, quality, reliability and full compliance with this specification for all equipment and systems offered by the Bidder.
1.01.05	Bidder shall furnish with his proposal the original Technical Data Sheets completely filled in.
1.01.06	It may be noted that this technical data sheets section is generally meant for Bidding purpose only. During detailed engineering, the Bidder shall be required to furnish all additional data about the equipment/system being supplied, even if such details are not asked for in this section.
1.01.07	a) Bidder should legibly fill in all the data asked for in these sheets either by hand in black ink or preferably by typing the matter. All the filled in data sheets should be duly returned with the bid. b) Continuation sheets may be suitably attached whenever the need arises. These pages may be suitably numbered accordingly. c) Corrections should be avoided. However, whenever it is imperative to carry out correction, this should be done neatly and should be initiated by the authorised signatory.

d) Each page of the data sheet should be initiated by the authorised signatory & should bear the legal stamp of the company.

e) Bidder should indicate his name on each sheet.

1.01.08 In case the BIDDER proposes to take any deviations/exceptions to the tender requirements, the same shall be listed in an orderly manner under Schedule of technical deviations of Bid Forms. Each page of the filled schedule shall be signed & duly stamped by the BIDDER.

1.01.09 BIDDER is required to ensure that no contradictions will be brought out on the information/data/writeup/drg. provided with the bid. In the event of any contradictions, views of the Employer will be final.

2.00.00 ESSENTIAL DATA TO BE FURNISHED ALONG WITH THE BID

1) All HT Loads along with rating.

2) Requirement of DG and DC supply for drives along with ratings.

3) Auxiliary Steam requirement

4) Cooling water requirement and temperature rise along with breakup for each auxiliary

5) Process water requirement

6) Instrument & Service air requirement

7) Waste water generated & its constituents

8) Any other interface data required by the Employer

9) Layout Drawings of the FGD System offered.

CHAPTER - II

TECHNICAL INFORMATION TO BE SUBMITTED ALONG WITH THE BID

MODULE - I

MECHANICAL

SUB-SECTION - DM0

GENERAL REQUIREMENTS

CLAUSE NO.	BIDDER'S NAME
1.00.00	**GENERAL REQUIREMENTS**
1.01.00	**INSTRUCTIONS TO BIDDERS**
1.01.01	Part-F describes the technical information and data to be submitted by the Bidder alongwith the proposal for the equipment and services described in Section-VI.
1.01.02	The Bidder shall ensure that all information, data, performance curves, technical literature (catalogues) and drawings furnished with the proposal fully describe all equipment/systems covered under this proposal and fully meet the requirements of the technical specifications.
1.01.03	The Bidder shall use one of the following responses while filling the questionnaire and proposal and fully meet the requirements of the technical specifications. a) The Section No. and Page No. of the proposal where the required information/data has been furnished by the Bidder. b) An answer (data or narrative description). c) A Not-Applicable statement (N.A.)
1.01.04	Bids not meeting the above requirement or not containing full description/data/technical literature/details regarding past experience for similar application for the proposed equipment may be treated as non responsive and this will be considered as an adequate reason for rejection of the concerned Bid.
1.01.05	The Employer reserves the right to ask for further details regarding technical features, application particulars, performance, past experience for similar applications or any other information as may be required to fully satisfy himself regarding suitability, quality, reliability and full compliance with this specification for all equipment and systems offered by the Bidder.
1.01.06	Bidder shall furnish with his proposal the original Technical Data Sheets completely filled in and five photostat Copies of the data sheets (photocopies of the original). In no case, the Bidder shall retype/redraft these data sheets.
1.01.07	It may be noted that this technical data sheets section is for Bidding purpose only. During detailed engineering, the Bidder shall be required to furnish all additional data about the equipment/system being supplied, even if such details are not asked for in this section.
1.01.08	a) Bidder should legibly fill in all the data asked for in these sheets either by hand in black ink or preferably by typing the matter. All the filled in data sheets should be duly returned with the bid. b) Continuation sheets may be suitably attached whenever the need arises. These pages may be suitably numbered accordingly. c) Corrections should be avoided. However, whenever it is imperative to carry out correction, this should be done neatly and should be initiated by the authorised signatory. d) Each page of the data sheet should be initiated by the authorised signatory & should bear the legal stamp of the company.

CLAUSE NO.	BIDDER'S NAME
	e) Bidder should indicate his name on each sheet.
1.01.09	In case the BIDDER proposes to take any deviations/exceptions to the tender requirements, the same shall be listed in an orderly manner under Schedule of technical deviations of Bid Forms. Each page of the filled schedule shall be signed & duly stamped by the BIDDER.
1.01.10	BIDDER is required to ensure that no contradictions will be brought out on the information/data/writeup/drg. provided with the bid. In the event of any contradictions, views of the Employer will be final.

SUB-SECTION – DM1

FLUE GAS DBSULPHURISATION (FGD) SYSTEM

CLAUSE NO.	BIDDER'S NAME
	TECHNICAL INFORMATION / DATA TO BE SUBMITTED ALONGWITH THE BID
1.00.00	**GENERAL TECHNICAL INFORMATION / DATA DRAWINGS FOR FLUE GAS DESULPHURIZATION SYSTEM**
1.01.00	**Performance Data for FGD**
1.01.01	Characteristic/Correction Curves for Absorber i) Gas flow rate vs SO2 removal efficiency for all specified coals (Guarantee Point/Design point) ii) Inlet SO2 concentration vs SO2 removal efficiency for all specified coals (Guarantee Point/Design point) iii) Inlet dust concentration vs Dust Removal efficiency for all specified coals (Guarantee Point/Design point) iv) Gas Flow Rate vs Pressure Drop v) Inlet Gas Temperature vs. Stack Inlet Temperature vi) Gas Flow Rate vs. Stack Inlet Temperature vii) Gas Flow Rate vs. Water Consumption viii) Inlet Gas Temperature vs. Water Consumption ix) Characteristic curves for the Limestone Pulverizer a) Variation of pulverizer capacity with Limestone Bond Index (other conditions to be defined) b) Variation in Pulverizer Capacity with Limestone Output Fineness (other conditions to be defined) c) Energy consumption per tonne through put of pulverizer for varying pulverizer output

d) Variation of wear life of pulverizer components with Limestone Bond Index

x) Characteristic curves of the Recirculation Slurry pumps

xi) Characteristic curves of the Limestone Slurry pumps

xii) Characteristic curves of the Gypsum Bleed pumps

xiii) Characteristic curves of the Mist Eliminator Wash Water Pumps

xiv) Characteristic curves of the Process Water pumps

xv) Characteristic curves of the Filter Water pumps

xvi) Characteristic curves of the Vacuum pumps

xvii) Characteristic curves of the Sump pumps

xviii) Characteristic Curves for Primary Hydro-cyclones

xix) Characteristic Curves for Secondary Hydro-cyclones

xx) Characteristic Curves for Pulverizer Hydro-cyclones

1.02.00 **Supplementary Data for FGD System**

i) A complete list of all the equipment requiring the following shall be furnished indicating parameters continuous requirements and the maximum requirement together with schematic diagrams

a) Cooling water

b) Service air

c) Instrument air

d) Auxiliary steam

e) Number and electrical rating of AC power supply feeders at available voltage for each control instrumentation system in Bidder's scope

f) Process water

ii) Schedule of power consumption .....

iii) Complete schedule of motors giving voltage, phase, KW rating (calculated and installed capacity), service factor etc.

iv) Recommended mode of erection sequence and other relevant particulars in respect of installation of :

a) Structural Steel

b) Rotating Equipment

c) Static Equipment

d) Others

v) Detailed recommended procedures for welding and erection

vi) A comparison and history of all FGDs in service of similar design and size to that proposed including descriptions of operating difficulties.

vii) A complete list of local instruments, sensing devices and control equip-ment covered in the proposal with type, make, accuracy, range, details, dial size etc. in the Bidder's scope.

viii) Schedule of control valves giving type and make of valves and actuators, size, body and trim material etc. stroke length, stroking time and full technical particulars of valves and their actuators and associated accessories.

CLAUSE NO.	BIDDER'S NAME

ix) Schedule of dampers and vanes with full particulars of dampers and their actuators, (for powered dampers) such as type of actuator, make, torque rating, stroke and stroking time, electrical rating/ pneumatic consumption limit and torque switch position transmitter details

x) List of special maintenance tools included in the proposal

xi) List of insert panels, control cabinets and local control panels included in the proposal with GA drawings, mounting and output details

xii) List of field mounted junction boxes included in the proposal.

xiii) List and details of instruments & control items supplied loose for mounting on control panels, including details like type. make, cutout & drawings etc.

xiv) Temperature sensors calibration standards

xv) List of annunciations giving suggested set values of parameters List of inputs provided for Data Acquisition System

xvi) Particulars of prefabricated & other special cables included in Bidder's scope

xvii) Write up on FGD internals including spray system, oxidation system, mist eliminators, supporting structures, etc.

xviii) Write up on Absorber Auxiliaries like Slurry recirculation pumps, oxidation compressors, gypsum bleed pumps, agitators etc .....

CLAUSE NO.	BIDDER'S NAME
	xix) Write up on operating procedures and control philosophy xx) Write up on interlocks and protections xxi) Detailed calculations for working out of FGD inlet gas flow, gas temperature, inlet SO2 concentration, SO2 removal efficiency, water evaporation, stack inlet temperature, limestone feed and gypsum bleed. ..... xxii) Detailed sizing calculation for slurry recirculation pumps, oxidation air compressors, gypsum bleed pumps, oxidation tank capacity ..... xxiii) Details of manufacturing and erection tolerances for FGD internals. xxiv) Write up on Limestone Grinding System including mills and all auxiliaries like mill circuit pumps, separator tank, agitators, hydro-cyclones etc xxv) Write up on Gypsum Dewatering System including Vacuum Belt Filters, hydro-cyclones and all auxiliaries like vacuum receiver, vacuum pump, vacuum breaker, agitators, etc xxvi) Write up on Waste Water Treatment System including all auxiliaries like hydro-cyclones, pumps, neutralization system, etc xxvii) Write-up on Handling System for Heavy equipments as per specification
1.03.00	**Drawings** i) General arrangement drawing (Plan and elevation) with appropriate dimensions ii) Layout of FGD structural steel

columns. These shall indicate the size of members and main dimensions, with design loadings and all lifting facilitate for purposes of maintenance.

iii) Arrangement of platforms, walkways and galleries

iv) Schematic diagram indicating terminal points and instrumentation & controls included in Bidder's scope and suggestive scheme for flue gas system, limestone grinding system and gypsum dewatering system indicating, pipe duct size (OD's and ID's) operating parameters, maximum fluid velocities, water balance, insulation thickness and material specification etc.

v) Location plan - Details of location and arrangement scheme of columns embedment and fixing details, size of pedestals, levels blockouts & anchor bolts. and channels indicating scope of supply by equipment supplier

vi) Loading on foundations : .....
Axial load, bending moments and shear forces transmitted to foundations of following loading combinations separately.

a) Dead load

b) Live load

c) Wind load

d) Seismic load

vii) Complete bracing arrangements for FGD supporting structures and combinations of (+v) and (-v) forces for the seismic or wind (whichever is governing)

viii) Percentage of live load considered for calculating wind and seismic forces

ix) Recommended size and general arrangement of FGD control room in plan and sections along with its location plan.

CLAUSE NO.	BIDDER'S NAME		
	x) Schedule of heat load for air conditioning		
	xi) Gas distribution system	.....	
	xii) Absorber, Slurry spray system, mist eliminator and washing system including support details		
	xiii) Oxidation Tank and oxidation nozzle including support details and location of agitators, level indicators and other instruments		
	xiv) Weather proof enclosure and lifting		
	xv) Schematic diagram controls and diagrams		
	xvi) Interconnecting wiring diagrams		
1.04.00	**Predicted Performance**	**Guarantee point** D/W/B* Coal at…… m3/s Gas flow rate at …….. deg C	**Design point** D/W/B* Coal at…… m3/s Gas flow rate at …….. deg C
	1. Boiler Load in MW (e)		
	2 Type of Coal		
	3 Ambient air condition		
	4 Coal Flow (T/hr)		
	5 Gas flow at the FGD inlet when firing respective coal (Nm^3/sec)*		
	6 Gas temperature at FGD inlet (deg.C)		
	7 Flue Gas Composition at FGD system inlet:		

(i) O_2 (% v/v wet)
(ii) CO_2 (% v/v wet)
(iii) H_2O (% v/v wet)
(iv) SO_2 (% v/v wet
(v) N_2 (% v/v wet)
(vi) Inlet SO_2 (mg/Nm^3-wet)

(vii) NO_x
(viii) Dust (mg/Nm^3)

* Strike whichever is not applicable

8 Flue Gas Composition at FGD system inlet (6% O_2):

(i) O_2 (% v/v dry)
(ii) CO_2 (% v/v dry)
(iii) H_2O (% v/v dry)
(iv) SO_2 (% v/v dry)
(v) N_2 (% v/v dry)
(vi) Inlet SO_2 (mg/Nm^3-dry)
(vii) Inlet HCL (ppmw)
(viii) Inlet HF (ppmw)

9 Flue Gas Composition at Absorber outlet:

(i) O_2 (% v/v wet)
(ii) CO_2 (% v/v wet)
(iii) H_2O (% v/v wet)
(iv) SO_2 (% v/v wet
(v) N_2 (% v/v wet)
(vi) SO_2 (mg/Nm^3-wet)
(vii) Dust (mg/Nm^3)
(vii) Outlet HCL (ppmw)
(viii) Outlet HF (ppmw)

10 Flue Gas Composition at Absorber outlet: (6% O_2):

(i) O_2 (% v/v dry)
(ii) CO_2 (% v/v dry)
(iii) H_2O (% v/v dry)
(iv) SO_2 (% v/v dry)

(v) N_2 (% v/v dry)
(vi) SO_2 (mg/Nm^3-dry)
(vii) Dust (mg/Nm^3)

11 SO_2 removal Efficiency (%)

12 Availability (%)

13 Gypsum Quality

Moisture content (free)	: ..... wt%
Purity of $CaSO_4 \cdot 2H_2O$	: ..... wt%-d
$CaSO_3$	: ..... wt%-d
$CaSO_3 \cdot 1/2H_2O$	: .....wt%-d
Cl^-	: .....ppm-d
Mg^{2+}	: ..... ppm-d
Na^+	: ..... ppm-d
pH	: _.....
Color	: _.....
Odour	: _.....

14 SO3 conversion from SO2(%):

15 Pressure Loss

(a) FGD Total : .....mmwc

(b) Absorber + M/E : .....mmwc

16 Gas Flow at Inlet to Absorber (kg/hr.)

17 Gas Temperature at Inlet to Absorber (0 C)

18 Gas Pressure at Inlet to Absorber (mmwc)

19 Gas Flow at Inlet to Absorber (kg/hr.) after quenching

20 Gas Flow at Inlet to Absorber (m3/hr.) after quenching

21 Gas Flow at Inlet to Absorber (Nm3/hr.)

		after quenching
	22	Gas Temperature at Inlet to Absorber (oC) after quenching
	23	Gas Pressure at Inlet to Absorber (mmwc) after quenching
	24	Gas Flow at Absorber Outlet (kg/hr.)
	25	Gas Flow at Absorber Outlet (m3/hr.)
	26	Gas Flow at Absorber Outlet Outlet (Nm3/hr.)
	27	Gas Temperature at Absorber Outlet (oC)
	28	Gas Pressure at Absorber Outlet (mmwc)
	29	Inlet SO2 concentration (mg/Nm3) at Absorber inlet
	30	Outlet SO2 concentration (mg/Nm3) at Absorber outlet
	31	Inlet Dust Burden (mg/Nm3)
	32	Outlet Dust Burden (mg/Nm3) .
	33	Limestone Consumption (kg/hr)
	34	Ca/S Molar Ratio (Based on Inlet Gas SO2)
	35	Gypsum Produced (kg/hr)
	36	Oxidation Air Flow (kg/hr.)
	37	Oxidation Air Flow (Nm^3/hr.)
	38	Oxidation Air Temperature (°C)
	39	Excess Air over stoichiometric requirement (%)
	40	Water Consumption (m3/hr)
		a) Mist Eliminator Wash Water

b) Make-up Water

c) Limestone feed

d) Gypsum Carry over

e) Waste Water

41 Recirculation Slurry Flow (m3/hr)

42 Recirculation Slurry Solid Concentration (% w/w)

43 L/G Ratio

44 Gypsum bleed Slurry pH

45 Limestone Slurry pH

46 Limestone Slurry Solid Concentration (% w/w)

47 Gypsum Bleed Solid Concentration (% w/w)

48 SO2 removal efficiency with one spray level out of service (for multiple levels of spray)

OR

SO2 removal efficiency with one spray pump out of service (for single level spray)

49 Waste Water Analysis

50 Lime consumption for waste water neutralization (kg/hr.).

51 Power consumption (KW)

1.05.00 **MASS BALANCE DIAGRAM & DATA** **Guarantee point** **Design point**

2.00.00 **EQUIPMENT DATA**

2.01.00 **Gas Ducts**

Absor-

				Hot Gas Inlet	ber Bypass Duct
	i)	Cross Sectional Area (m2)		.....	.....
	ii)	Dimensions (m x m x m/dia)		.....	.....
	iii)	Material / Thickness (mm) of Duct		.....	.....
	iv)	Material / thickness (mm) of Lining		.....	.....
	v)	Method of lining (Lining / Cladding / Wallpaper)		.....	.....
	vi)	Estimated Life of liners (hrs.)		.....	.....
	vii)	Max. Velocity through ducts at Design Point (m/s)		....	.....

				Fan Inlet Gate	Fan Outlet Gate	
2.02.00	**Guillotine Gates/Dampers**					
	i)	Manufacturer		.....	.....	.
	ii)	Size (m x m)		.....	.....	
	iii)	Material / Thickness of				
		a)	Plate	.....	.....	
		b)	Frame	.....	.....	
		c)	Seals	.....	.....	
	iv)	Actuator Type		.....	.....	.
	v)	Actuator Rating (KW)		.....	.....	.
	vi)	Sealing Efficiency (without Seal Air fans) (%)		.....	.....	
	vii)	No. of Seal Air Fans provided		.....	.....	
	viii)	Sealing Efficiency with Seal Air fans (%)		.....	.....	
	ix)	Seal Air Fan Flow / Head (M3/hr./mmwc)		.....	.....	
	x)	Heater type provided		.....	.....	.
	xi)	Heater rating		.....	.....	

CLAUSE NO.	BIDDER'S NAME
2.03.00	**Absorber**

i)	Manufacturer		.....
ii)	Manufacturer's model number		.....
	a)	Absorber Cross Sectional Area (m2)	.....
	b)	Absorber Dimension (mxmxm (Width x Depth x Height) or (Dia x Height)	.....
	c)	Oxidation Tank Dimension (mxmxm) (WidthxDepthxHeight) or (Dia x Height)	.....
	d)	Height between support level to top of support steel (m)	.....
iv)	Number of spray levels (Working + Stand-by)		.....
v)	Number of spray nozzles per spray level per boiler		.....
vi)	Number of redundant spray nozzles per level		.....
vii)	No. of slurry pumps per spray level		.....
viii)	Maximum slurry flow (m3/hr)		.....
ix)	L/G Ratio		.....
x)	No. of agitators		.....
xi)	No. of redundant agitaors		.....
xii)	No. of oxidation nozzles		.....
xiii)	No. of redundant oxidation nozzles		.....
xiv)	Guaranteed SO2 removal efficiency (%)		.....
xv)	Dust Removal Efficiency (%)		.....
xvi)	Guaranteed pressure drop across Gas System (mmwc)		.....
xvii)	Guaranteed Stack Inlet		

	Temperature (oC)	.....		
xviii)	Limestone Consumption (kg/hr)	.....		
xix)	Gas velocity through Absorber (M/sec)	.....		
xx)	Gypsum Residence time (sec) in oxidation Tank	.....		
xxi)	Aspect ratio	.....		
xxii)	Proposed standard for conducting the performance tests	.....		
xxiii)	SO2 removal efficiency with one spray level out of service (for multiple levels of spray)			
	OR			
	SO2 removal efficiency with one spray pump out of service (for single level spray)			
xxiv)	SO2 removal efficiency with max. SO2 concentration (from the range of specified coals) (%)			
xxv)	Slurry pH under conditions xxiv)			
xxvi)	Limestone consumption under conditions xxiv) (kg/hr.)			
xxvii)	Gypsum flow under conditions xxiv) (kg/hr.)			
xxviii)	Material / Thickness (mm) of		Base Material	Lining
	a) Absorber and lining			
	b) Wet Dry Interface and lining			
	c) Oxidation Tank and Lining			
	d) Absorber Inlet Duct and Lining			
	e) Absorber Outlet Duct and Lining			
	f) Mist Eliminators			
	g) Mist Eliminator Was Water Header and Nozzles			

h) Spray Headers

i) Spray Nozzles

j) Oxidation Nozzles

k) Oxidation headers

l) Internal Supporting members of absorber, spray piping, mist eliminators etc.

xxix) Type of lining for absorber and ducts (Lining / Cladding / Wallpaper)

xxx) Design pressure (mmwc) .....

xxxi) Design temperature (deg C) .....

xxxii) Max. temperature with stand capacity and duration (oC)

xxxiii) Number of inspection doors .....

xxxiv) Dimensions of access openings of inspection doors (mm x mm)

xxxv) Emergency Storage tank Capacity (hrs. of operation)

xxxvi) Spray Nozzle

a) Make / Model

b) Type

c) Spray cone angle

xxxvii) Oxidation Nozzles

a) Make / Model

b) Type

xxviii) Spray Header Diameter (mm)

xxix) Oxidation Header Diameter (mm)

xxx) Distance between two consecutive spray levels (mm)

CLAUSE NO.	BIDDER'S NAME
2.04.00	**Slurry Recirculation Pumps** **(To be indicated for each level)** i) No. of pumps ii) No. of stand-by pumps iii) Manufacturer iv) Model v) Type vi) Rated Capacity a) Flow (m3/hr.) b) Head (mWCl) c) Power (KW) d) Efficiency (%) e) Slurry Concentration (% w/w) vii) Max. Slurry Concentration (% w/w) viii) Margin a) Flow (%) b) Head (%) ix) Motor Rating (KW) x) Motor Details (volts/H2) xi) Speed (rpm) xii) Synchronous Motor speed (rpm) xiii) Critical Speeds (rpm) xiv) Impeller a) Impeller type b) Impeller Diameters (mm) c) Shaft Material/Diameter (mm) d) Material / Thickness of Impeller (mm)

CLAUSE NO.	BIDDER'S NAME
	e) Lining Material / Thickness (mm) xv) Casing Type xvi) Casing Material/Thickness (mm) xvii) Casing Liner Materials/ Thickness (mm) xviii) Life of Impeller/Casing Liners (hrs.) xix) Weight of Rotating Parts (kg) xx) Weight of Static Parts (kg) xxi) Type of Seal xxii) Seal Water Flow (m3/hr) xxiii) Cooling Water Flow (m3/hr) xxiv) Bearings a) Number b) Type xxv) Type of Coupling xxvi) Reference Drg. Nos.
2.05.00	**Absorber Tank Agitators** a) No. of Agitators in each absorber b) No. of redundant agitators in each absorber c) Make / Model d) Type e) Speed (rpm) f) Drive Mechanism g) Shaft Material

CLAUSE NO.	BIDDER'S NAME
	h) Material/Thickness of Impeller / Lining (mm)
	i) Power Consumption (KW)
	j) Motor Rating (rpm)
	k) Motor Speed (rpm)
2.06.00	**Oxidation Air Compressors**
	i) No. of compressors
	ii) No. of stand-by compressors
	iii) Manufacturer
	iv) Model
	v) Type
	vi) Rated Capacity
	a) Flow (m3/hr)
	b) Head / Discharge Pressure (mmWCI/kgf/m2)
	c) Power (KW)
	d) Efficiency (%)
	vii) Margin
	a) Flow (%)
	b) Head (%)
	viii) Design Ambient Conditions (Temperature / Relative Humidity) (oC / %)
	ix) Motor Rating (KW)
	x) Motor Details (Volts/H2)
	xi) Speed (rpm)
	xii) Synchronous Motor speed (rpm)
	xiii) Critical Speeds (rpm)
	xiv) Impeller

CLAUSE NO.	BIDDER'S NAME		
	a) Impeller type		
	b) Diameter (mm)		
	c) Shaft Material /Diameter (mm)		
	d) Material / Thickness of Impeller (mm)		
	xv) Casing Type		
	xvi) Casing Material / Thickness (mm)		
	xvii) Casing Liner Materials / Thickness (mm)		
	xviii) Weight of Rotating Parts (kgs.)		
	xix) Weight of Static Parts (kgs.)		
	xx) Type of Seal		
	xxi) Cooling Water Flow Requirement (m3/hr)		
	xxii) Bearings		
	a) Number		
	b) Type		
	c) Lubrication		
	xxiii) Type of Coupling		
	xxiv) Reference Drg. Nos.		
2.07.00	**Slurry Pumps**	**Limestone Slurry Pump**	**Gypsum Bleed Pump**
	i) No. of pumps for each unit		
	ii) No. of stand-by pumps for each unit		
	iii) Manufacturer		
	iv) Model		
	v) Type		

vi) Rated Capacity

- a) Flow (m3/hr)
- b) Head (mWC)
- c) Power (KW)
- d) Efficiency(%)
- e) Slurry Concentration (% w/w)

vii) Max. Slurry Concentration (% w/w)

viii) Margin

- a) Flow (%)
- b) Head (%)

ix) Motor Rating KW

x) Motor Details (volts/H2)

xi) Speed (rpm)

xii) Synchronous Motor speed (rpm)

xiii) Critical Speeds (rpm)

xiv) Impeller

- a) Impeller type
- b) Diameters (mm)
- c) Shaft Material /Diameter (mm)
- d) Material/Thickness of Impeller (mm)
- e) Lining Material/Thickness (mm)

xv) Casing Type

xvi) Casing Material/Thickness (mm)

xvii) Casing Liner Materials/Thickness (mm)

xviii) Life of Impeller/Casing Liners

CLAUSE NO.	BIDDER'S NAME	
	(hrs.)	
	xix) Weight of Rotating Parts (kgs.)	
	xx) Weight of Static Parts (kgs.)	
	xxi) Type of Seal	
	xxii) Seal Water Flow (m3/hr)	
	xxiii) Cooling Water Flow (m3/hr)	
	xxiv) Bearings	
	a) Number	
	b) Type	
	xxv) Type of Coupling	
	xxvi) Reference Drg. Nos.	
2.08.00	**Limestone Grinding and Slurry Preparation system**	
2.08.01	**Bunker shut off gates**	
	i) Manufacturer	.....
	ii) Type	.....
	iii) Material of the gates	.....
	iv) Motor rating (KW)	.....
2.08.02	**Down spout**	
	i) Manufacturer	.....
	ii) inside diameter (mm)	.....
	iii) Thickness (mm)	.....
	iv) Height (mm)	.....
	v) Material	.....
	vi) Off set between feeder outlet and centre line of Limestone bunker, if any	.....
2.08.03	**Raw Limestone feeders**	
	i) Manufacturer	.....

	ii)	Type	.....
	iii)	Feeder size	.....
	iv)	Normal capacity (tonnes/hr)	.....
	v)	Maximum capacity (tonnes/hr)	.....
	vi)	Method of output control	.....
	vii)	Speed pulser allowable VA burden	
	viii)	Feeder belt width (mm)	.....
	ix)	Auxiliary power consumption (KW)	.....
		At 100% BMCR (DC / WC)	
		At 100% TMCR (DC / WC)	
		At 100% BMCR (Best Coal in Range)	
	x)	Type of Drive	.....
2.08.04	**Limestone Feeders**		
	i)	Manufacturer	.....
	ii)	Model Number	.....
	iii)	Method of measurement	.....
	iv)	Range of measurement (kg/hr)	.....
2.08.05	**Downspout from feeder outlet to pulverizer**		
	i)	Manufacturer	.....
	ii)	inside diameter (mm)	.....
	iii)	Thickness (mm)	.....
	iv)	Material	.....
	v)	Height (mm)	.....
	vi)	Off set between feeder outlet and centre line of limestone bunker, if any (m)	.....
2.08.06	**Limestone Pulverizers**		

CLAUSE NO.	BIDDER'S NAME

A. Design Data :

i) Manufacturer

ii) Type and model

iii) Total Number of mills

iv) Mill maximum capacity (kg/hr)

v) Size of raw limestone at mill inlet (mm)

vi) Bond Index of Limestone

vii) Fineness of pulverized coal through 325 mesh (%)

viii) Pulverizer Speed (rpm)

ix) Total Limestone consumption (kg/hr) with all units working at

x) 100% BMCR (DC/WC/Best of Range)

xi) 100% TMCR (DC/WC/Best of Range)

Number of mills working with all units working at

100% BMCR (DC/WC/Best of Range)

100% TMCR (DC/WC/Best of Range)

xii) Mill loading of working mills (% of maximum capacity) when no of mills as per (I) are operating

xiii) Mill Power Consumption

xiv) Mill Main Motor Rating (KW)

xv) Main Motor (Voltage/H2/rpm)

xvi) Overall dimensions

xvii) Total weight including motor

xviii) Solid Concentration (w/w %) in mill

xix) Method of Classification

xx) Ball Consumption (kg per ton of limestone)

B. Constructional Features

i) Material / Thickness of Mill Wear Liners

ii) Guaranteed Wear Life of Wear Liners

iii) Estimated labour (in man hours) for replacement of wear liners)

iv) Material / Diameter (mm) of Ball

C. Type of drive transmission

a) Make / Model of Gearbox

b) Speed Ratio

D. Type of coupling

E. Pulverizer lube oil system

a) No. of lube oil pumps per pulverizer

b) No. of lube oil pumps working

c) No. of oil coolers per pulverizer

d) No. of oil coolers per working

F. Auxiliary Motor Rating (KW)

G. Mill speed with Auxiliary Motor (rpm)

H. Mill Separator Tank

i) Capacity (m3)

ii) Material/Thickness (mm)

iii) Lining Material/Thickness (mm)

iv) No. of Agitators

I. Mill circuit Pump

i) No. per mill

ii) No. of stand-by pumps

iii) Make/Model

iv) Impeller Type

v) Material/Thickness (mm) of Impeller and lining

vi) Casing Type

vii) Material/Thickness (mm) of Casing/Lining

viii) Rated Flow Head (m3/hr / mWCl)

ix) Slurry Solid concentration (w/w %)

J. Agitators

i) No./Make/Model

ii) Type

iii) Speed (rpm)

iv) Drive Mechanism

v) Shaft Material

vi) Material / Thickness (mm) of Impeller / Lining

vii) Power Consumption

viii) Motor Rating (KW)

ix) Motor Speed (rpm)

K. Hydro-cyclone

i) Make / Model

ii) Number working

iii) Flow Capacity (m3/hr)

iv) Inlet Solid Concentration (% w/w)

v) No. of Hydro-cyclone in each set

vi) No. of spare hydro-cyclone in each set

vii) Under flow

Volume (m3/hr)

Solid Concentration (% w/w)

viii) Overflow

Volume (m3/hr)

Solid Concentration (% w/w)

ix) Size / Material / Thickness (mm) of base / Lining

a) Feed Chamber

b) Apex Stopper

c) Cone Casing

d) Under flow pipe

e) Overflow pipe

x) Pressure Drop at rated capacity (mmWCl)

xi) Design Pressure

2.08.07 **Limestone Slurry Preparation Tank**

i) No. of Tank

ii) Capacity (m3)

iii) Slurry Solid concentration (w/w%)

CLAUSE NO.	BIDDER'S NAME
	iv) Tank Capacity at 100% BMCR (DC/WC/Best of range) (hrs.) v) Dimensions (WxDXH) vi) Material / Thickness (mm) vii) Lining Material / Thickness (mm) viii) No. of Agitators ix) No. of Redundant Agitators
2.08.08	**Limestone Slurry Tank Agitators** i) No. of Agitators in each Tank ii) No. of redundant agitators in each tank iii) Make / Model iv) Type v) Speed (rpm) vi) Drive Mechanism vii) Shaft Material viii) Material / Thickness (mm) of Impeller / Lining ix) Power Consumption (KW) x) Motor Rating (rpm) xi) Motor Speed
2.09.00	**Gypsum Dewatering System** i) No. of Streams ii) No. of Streams Stand-by iii) Primary Hydro-cyclone a) Make / Model b) Number working c) Flow Capacity (m3/hr)

d) Inlet Solid Concentration (% w/w)

e) No. of Hydro-cyclone in each set

f) No. of spare hydro-cyclone in each set

g) Under flow

Volume (m3/hr)

Solid Concentration (% w/w)

h) Overflow

Volume (m3/hr)

Solid Concentration (% w/w)

i) Size (mm) / Material / Thickness (mm)

Feed Chamber

Apex Stopper

Cone Casing

Under flow pipe

Overflow pipe

j) Pressure Drop at rated capacity (mmWCI)

k) Design Pressure (kgf/cm2)

iv) Vacuum Belt Filters

a) Manufacturer

b) Model

c) Dimensions (W x L x H) (m x m x m)

d) Cloth Width (m)

e) Cloth Length (m)

f) No. Working / Stand-by

g) Capacity (Guaranteed)

Gypsum (Dry) (kg/hr)

Gypsum (Slurry) (m3/hr)

h) Inlet Flow
Volume (m3/hr)
Solid Concentration (% w/w)

i) Gypsum Flow (Dry) kg/hr

j) Moisture Removed (%)

k) No. of stages of cake washing / water flow (m3/hr)

l) No. of stages of cloth washing / water flow (m3/hr)

m) Design Pressure of Vacuum Chamber (kgf/cm2/a)

n) Operating Pressure of Vacuum Chamber (kgf/cm2/a)

o) Material / Thickness (mm)

Casing

Cloth

Gypsum Discharge Hopper

Vacuum Box

p) Life of Cloth (hrs.)

q) Type /Material of Carrying Belt

r) Type / Material of Sealing Belt

s) Life of Carrying Belt (hrs.)

t) Life of Sealing Belt (hrs.)

u) Automatic Cloth Tensioning Mechanism Provided YES/NO

v) Vacuum Receiver Tank

a) No. of Tank

b) Capacity (m3)

c) Dimensions (Dia x Height) (mm x mm)

d) Material / Thickness (mm)

e) Lining Material / Thickness (mm)

vi) Vacuum Pumps

a) Make / Model

b) Type

c) No. of Pumps for each Vacuum Belt Filter

d) Rated Capacity Flow/ Head/ Power (m3/hr/mWCI/KW)

e) Power Consumption (KW)

f) Pump Speed (rpm)

g) Motor Rating (KW)

h) Motor Speed (rpm)

i) Margins (Flow / Head) (% / %)

j) Operating Pressure (kgf/cm2/a)

k) Design Pressure (kgf/cm2/a)

l) Material / Thickness (mm) of Base/Lining

Casing

Shaft

Impeller

m) Type of Seal

n) Sealing Water Flow (m3/hrs)

o) Bearing

CLAUSE NO.	BIDDER'S NAME			
		No. of Bearings		
		Type of Bearings		
	p)	Type of coupling		
	q)	Whether Silencer Provided at Outlet	YES/NO	
	vii)	Filtrate Tank		
	a)	No. of Tank		
	b)	Capacity (m3)		
	c)	Dimensions (WxDXH)		
	d)	Material / Thickness (mm)		
	e)	Lining Material/Thickness		
2.10.00	**Slurry Pipes**		**Recircula-tion Slurry**	**Limestone Slurry** **Gypsum Slurry**
	i.	Pipe size (mm)		
	ii.	Type of Joints		
	a)	Pipe to Pipe/Pipe to Fittings		
	b)	Fittings		
	iii.	Material / Thickness (mm) of Pipe		
	iv.	Material Thickness of lining		
	v.	Estimated Life of liners (hrs.)		
	vi.	Slurry Solid concentration (w/w %)		
	vii.	Slurry Settling Velocity (m/s)		
	viii.	Pipe Velocity (m/s)		
2.11.00	**Secondary Waste Water Hydro-cyclone Feed Tank**			
	a)	No. of Tank		
	b)	Capacity (m3)		
	c)	Dimensions (WxDXH)		

CLAUSE NO.	BIDDER'S NAME
	(m x m x m) d) Material / Thickness (mm) e) Lining Material / Thickness (mm)
2.11.01	**Secondary Waste Water Hydro-cyclone Feed Pump** a) No. b) No. of stand-by pumps c) Make / Model d) Impeller Type e) Material / Thickness (mm) of Impeller and lining f) Casing Type g) Material/Thickness of Casing/Lining h) Rated Flow/Head (m3/hr./mWCl) i) Slurry Solid concentration (w/w %)
2.11.02	**Secondary Waste Water Hydro-cyclone** a) Make / Model b) Number (working + standby) c) Flow Capacity (m3/hr.) d) Inlet Solid Concentration (% w/w) e) No. of Hydro-cyclone in each set f) No. of spare hydro-cyclone in each set g) Under flow Volume (m3/hr.) Solid Concentration (% w/w) h) Overflow

CLAUSE NO.	BIDDER'S NAME
	Volume (m3/hr.) Solid Concentration(% w/w) i) Size (mm)/ Material / Thickness (mm) of base / Lining a) Feed Chamber b) Apex Stopper c) Cone Casing d) Under flow pipe e) Overflow pipe j) Pressure Drop at rated capacity (mmwc) k) Design Pressure (kgf/cm2)
2.12.00	**Waste Water Tank** i) No. of Tank ii) Capacity (m3) iii) Dimensions (WxDXH) (m x m x m) iv) Material / Thickness (mm) v) Lining Material / Thickness (mm)
2.12.01	**Waste Water Pump** i) No. ii) No. of stand-by pumps iii) Make / Model iv) Impeller Type v) Material / Thickness (mm) of Impeller and lining vi) Casing Type vii) Material / Thickness (mm) of Casing / Lining

CLAUSE NO.	BIDDER'S NAME
	viii) Rated Flow Head (m3/hrs/mWCI)
	ix) Slurry Solid concentration (w/w %)
2.13.00	**Sump Pump (for absorber area, limestone grinding area and gypsum dewatering area sumps)**
	i) No.
	ii) No. of stand-by pumps
	iii) Make / Model
	iv) Impeller Type
	v) Material / Thickness (mmWCI) of Impeller and lining
	vi) Casing Type
	vii) Material/Thickness of Casing/ Lining
	viii) Rated/Flow Head
	ix) Slurry Solid concentration (w/w %)
2.14.00	**Absorbent Auxiliary Slurry Sump**
	i) Capacity (m3) Recommended
	ii) Slurry Solid concentration (w/w %)
	iii) No. of Agitators
	iv) No. of Redundant Agitators
2.15.00	**Absorbent Auxiliary Slurry Sump Agitators**
	i) No. of Agitators in Sump
	~~i~~i) No. of redundant agitators
	iii) Make / Model
	iv) Type
	v) Speed (rpm)
	vi) Drive Mechanism

CLAUSE NO.	BIDDER'S NAME
	vii) Shaft Material viii) Material / Thickness (mm) of Impeller / Lining ix) Power Consumption x) Motor Rating (KW) xi) Motor Speed (rpm)
2.16.00	**Absorbent Auxiliary Slurry ump Pumps** i) No. of pumps ii) No. of stand-by pumps iii) Manufacturer iv) Model v) Type vi) Rated Capacity a) Flow (m3/hr) b) Head (mWCl) c) Power (KW) d) Efficiency (%) e) Slurry Concentration (% w/w) vii) Max. Slurry Concentration (% w/w) viii) Margin a) Flow (%) b) Head (%) ix) Motor Rating (KW) x) Motor Details (volts/Hz) xi) Speed (rpm)

CLAUSE NO.	BIDDER'S NAME
	xii) Synchronous Motor speed (rpm) xiii) Critical Speeds (rpm) xiv) Impeller a) Impeller type b) Diameters (mm) c) Shaft Material /Diameter (mm) d) Material / Thickness (mm) of Impeller e) Lining Material / Thickness (mm) xv) Casing Type xvi) Casing Material / Thickness (mm) xvii) Casing Liner Materials / Thickness (mm) xviii) Life of Impeller / Casing Liners (hrs.) xix) Weight of Rotating Parts (kgs.) xx) Weight of Static Parts (kgs.) xxi) Type of Seal xxii) Seal Water Flow (m3/hr) xxiii) Cooling Water Flow (m3/hr) xxiv) Bearings a) Number b) Type xxv) Type of Coupling xxvi) Reference Drg. Nos.
2.17.00	**INSULATION AND CLADDING** i) Area to be insulated per unit (m2)

CLAUSE NO.	BIDDER'S NAME
	a) GGH Hot Gas Inlet Duct b) Absorber Inlet Duct c) Absorber d) Absorber Outlet duct e) GGH Cold Gas Inlet Duct f) Absorber Bypass Duct g) Stack Inlet Duct h) Total
	ii) Material .....
	iii) Insulating material standard .....
	iv) Thickness (mm) .....
	v) Density (Kg/M3) .....
	vi) Thermal conductivity (Kcal/m/hr/ deg.C) at mean temperature of a) 50 deg. C b) 100 deg. C c) 150 deg. C d) 200 deg. C
	vii) Resistive to micro organism (Yes/No)
	viii) Incombustibility (Yes/No) .....
	ix) Material of skin casing ..... x) Thickness of skin casing .....
3.00.00	**EQUIPMENT WEIGHT (TOTAL) (in tons) for 3x800 units**
	i) FGD System ..... a) Structural Steel ..... b) Absorber and Oxidation Tank casing ..... c) Slurry Spray Nozzles and Headers .....

d) Oxidation air nozzles and Headers .....

e) Mist Eliminators .....

ii) Ducts & Gates .....

iii) Recirculation Slurry Pumps and piping .....

iv) Oxidation Compressors and piping .....

v) Gypsum Bleed pump and piping .....

vi) Limestone Slurry Pumps and piping .....

vii) Limestone Grinding System .....

a) Feeders

b) Mills

c) Hydro-cyclones and pumps

d) Tanks

e) Structural Steels

viii) Slurry Tank Agitators .....

ix) Gypsum Dewatering System .....

a) Primary Hydro-cyclones

b) Vacuum Belt Filters

c) Vacuum Receivers & Pumps

d) Structural Steel

e) Secondary Hydro-cyclones

x) Slurry Pipes & Valves .....

xi) Elevators

	xii) Galleries, stair ways and walkways	.....
	xii) Thermal insulation and Cladding	.....
	xiv) Control and Instrumentation	.....
	xv) Limestone & Gypsum Handling System	
	xvi) ZLD System	
	xvii) Others	.....
	xviii) Total estimated weight	.....

4.00.00 **FGD WASTE WATER**

Pollutant	**Unit**	
FGD Waste water Flow	m^3/s	.....
Temeperature	deg C	.....
pH	-	.....
BOD	mg/l	.....
COD	mg/l	.....
SS	mg/l	.....
N-hexane extraction matter	mg/l	.....
Total Nitrogen	mg/l	.....
Total Phosphorous	mg/l	.....
CN	mg/l	.....
Phenol	mg/l	.....
Cr	mg/l	.....
Soluble Fe	mg/l	.....
Zn	mg/l	.....

Cu	mg/l	.....
Cd	mg/l	.....
Hg	mg/l	.....
Organic P	mg/l	.....
As	mg/l	.....
Pb	mg/l	.....
Cr+6	mg/l	.....
Soluble Mn	mg/l	.....
F	mg/l	.....
PCB	mg/l	.....
Trichloroethylene	mg/l	.....
Tetrachloroethylene	mg/l	.....
Anion Surfactant	mg/l	.....
TDS	mg/l	.....
Cl	mg/l	.....
Ca++	mg/l	.....
Mg++	mg/l	.....
Al+++	mg/l	.....
K+	mg/l	.....
Na+	mg/l	.....
SO4-	mg/l	.....
SO3-	mg/l	.....

CLAUSE NO.	BIDDER'S NAME
5.00.00	**DATA FOR REFERENCE PLANTS (USE ONE SEPARATE SHEET FOR EACH REFERENCE PLANT)**
5.01.00	**Power Plant details**
	i) Unit rating (MW)
	ii) Commissioning Date
5.01.01	**Absorber Design**
	i) Design flue gas flow (Nm3/hr)
	ii) Design flue gas temperature (deg C)
	iii) Design Pressure (mmWC)
	iv) Adiabatic temperature after quenching(°C)
	v) L/G Ratio at Design Point
	vi) Gas velocity at design flow (m/s)
	vii) No. of spray levels (working + stand-by) in each absorber
	viii) Minimum redundancy in slurry recirculation pumps
	ix) No of Agitators(working + stand-by)
	x) Diameter of Absorber (m)
	xi) Height of Absorber (m)
	xii) Height of slurry in the oxidation tank (design)
	xiii) Height of slurry in the oxidation tank(operating)
	xiv) Height of slurry in the oxidation tank(minimum)
	xv) Guaranteed power consumption(KW)
	xvi) Max. Inlet Dust Burden (mg/Nm3)
	xvii) Guaranteed Outlet Dust burden(mg/Nm3)
	xviii) Limestone slurry concentration (%) & pH
	xix) Gypsum bleed slurry concentration (%) & pH

CLAUSE NO.	BIDDER'S NAME	
	xx) Limestone slurry specific gravity	
	xxi) Gypsum bleed slurry specific gravity	
	xxii) Desulprisation removal efficiency (%)	
5.01.02	**Design fuel**	
	i) Fuel Type	
	ii) Ash Content (%)	
	iii) Moisture Content (%)	
	iv) Gross Calorific value (Kcal Kg)	
	v) Sulphur content (%) in coal	
5.01.03	**SO2 Removal Efficiency**	
	i) Guaranteed efficiency (%)	
	ii) Acceptance test efficiency (%)	
5.02.00	**FGD System Availability**	
6.00.00	**PROPOSED SUB-CONTRACTORS**	
	i) FGD System	.....
	ii) Structural Steel	.....
	iii) Absorber and Oxidation Tank casing	.....
	iv) Slurry Spray Nozzles	.....
	v) Oxidation air nozzles	.....
	vi) Mist Eliminators	.....
	vii) Ducts	.....
	viii) Gates	.....
	ix) Recirculation Slurry Pumps	.....
	x) Oxidation Compressors	.....
	xi) Gypsum Bleed and Limestone Slurry Pumps	.....

xii) Limestone Grinding System .....

a) Feeders

b) Mills

c) Hydro-cyclones

d) Tanks

xiii) Slurry Tank Agitators .....

xiv) Gypsum Dewatering System .....

a) Hydro-cyclones

b) Vacuum Belt Filters

c) Vacuum Receivers

d) Vacuum Pumps

xv) Slurry Pipes .....

xvi) Slurry Valves .....

xvii) Galleries ad stair ways .....

xviii) Internal walk ways .....

xix) Thermal insulation .....

xx) Cladding .....

xxi) Instruments .....

xxi) Booster Fans .....

MODULE - II

ELECTRICAL

SUB-SECTION - DB1

MOTORS

PART-I

TECHNICAL INFORMATION AND DATA TO BE SUBMITTED WITH THE PROPOSAL

DE-	**HT MOTORS**	
A.	**GENERAL**	
1.	Manufacturer & Country of origin.(Shall be as per approved QA make)	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure /Method of cooling/ Degree of	
4.	Applicable standards to which motor generally	
5.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
6.	Type of mounting	
7.	Direction of rotation as viewed from DE END	
8.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
9.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
10.	Maximum continuous load demand at design duty point of driven equipment in KW	
11.	Rated Voltage (volts)	
12.	Permissible variation of :	
a.	Voltage (Volts)	

b.	Frequency (Hz)	
c.	Combined voltage and frequency	
13.	Rated speed at rated voltage and frequency	
14.	At rated Voltage and frequency:	
a.	Full load current	
b.	No load current	
15.	Power Factor at	
a.	100% load	
b.	NO load	
c.	Starting.	
16.	Efficiency at rated voltage and frequency	
a.	100% load	
b.	75% load	
c.	50% load	

DE-1B	LT MOTORS	
A.	**GENERAL**	
1.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure /Method of cooling/ Degree of	
4.	Applicable standard to which motor generally	
5.	Efficiency class as per IS 12615	
6.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
7.	Type of mounting	
8.	Direction of rotation as viewed from DE END	
9.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
10.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11.	Maximum continuous load demand of driven	
12.	Rated Voltage (volts)	
13.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
14.	Rated speed at rated voltage and	
15.	At rated Voltage and frequency:	

	a. Full load current	
	b. No load current	
16.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
17.	Efficiency at rated voltage and frequrecy,	
	a.100% load	
	b. 75% load	
	c. 50% load	
C.	**Additional Data to be filled for each rating of DC Motor**	
1.	Rated armature voltage (Volt)	
2.	Rated field excitation (Amp)	
3.	Permissible % variation in voltage	
4.	Minimum Permissible Starting voltage (volt)	
5.	At rated voltage	
	i)Full load Armature current.(Amp)	
	ii)Full load Field current (Amp)	
	iii)No load Armature current (Amp)	
6.	Full load Field current (Amp)	
7.	No load Aramature current (Amp)	
8.	Minimum permissible field current(Amp) to avoid	
	i) Maximum permissible voltage	
	ii) Rated voltage	
	iii) Minimum Permissible Voltage	
9.	Resistance (indicative Values) in ohm	
	i)Armature winding(Arm + IP + Series) at 25	

	ii) Field Winding at 25 deg. C	
10..	Inductance (indicative values)	
	i) Armature winding	
	ii) Field winding	
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
	i) 220 V DC	
	ii) 250 V DC	
	iii) 187 V DC	
12	Value of the external resistance (ohm)required to be connected in series with armature during starting only	
13	Technical data sheet for external resistance box	
14	GA drawing of motor	
15	Starting time calculation	
16	Starter resistance design calculation	
17	Electrical connection diagram of motor	

PART-II

TECHNICAL INFORMATION AND DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT

DE-1A	**HT MOTORS**	
A.	**GENERAL**	
5.	Manufacturer & Country of origin.(Shall be as per approved QA make)	
6.	Equipment driven by motor	
7.	Motor type	
8.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
17.	Frame size	
18.	Type of duty	
19.	Type of enclosure /Method of cooling/ Degree of	
20.	Applicable standards to which motor generally	
21.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
22.	Type of mounting	
23.	Direction of rotation as viewed from DE END	
24.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
25.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
26.	Maximum continuous load demand at design duty point of driven equipment in KW	

27.	Rated Voltage (volts)	
28.	Permissible variation of :	
d.	Voltage (Volts)	
e.	Frequency (Hz)	
f.	Combined voltage and frequency	
29.	Rated speed at rated voltage and frequency	
30.	At rated Voltage and frequency:	
c.	Full load current	
d.	No load current	
31.	Power Factor at	
d.	100% load	
e.	NO load	
f.	Starting.	
32.	Efficiency at rated voltage and frequency	
d.	100% load	
e.	75% load	
f.	50% load	
33.	Starting current (amps) at	
a.	100 % voltage	
b.	85% voltage	
c.	80% voltage	
34.	Minimum permissible starting Voltage (Volts)	
35.	Starting time with minimum permissible voltage	
a.	Without driven equipment coupled	
b.	With driven equipment coupled	
36.	Safe stall time with 100% and 110% of rated voltage	
a.	From hot condition	
b.	From cold condition	

37.	Torques :	
a.	Starting torque at min. permissible voltage(kg-mtr.)	
b.	Pull up torque at rated voltage.	
c.	Pull out torque	
d.	Min accelerating torque (kg.m) available	
e.	Rated torque (kg.m)	
38.	Stator winding resistance per phase (ohms at 20 Deg.C.)	
39.	GD^2 value of motors	
40.	No of permissible successive starts when motor is in	
41.	Locked Rotor KVA Input	
42.	Locked Rotor KVA/KW	
43.	Vibration limit	
a.	Velocity (mm/s)	
b.	Displacement (microns)	
44.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process shall be VPI	Yes/No
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified max.	
	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	e. Method of temperature measurement	
	f. Stator winding connection	
	g. Number of terminals brought out	
2.	Type of terminal box for following:	
	a. Stator leads	

	b. Space heater	
	c. Temperature detectors(RTDs,BTDs)	
	d. Instrument switch etc.	
3.	Bearing	
	a. Type DE/NDE	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended lubricant	
	e. Oil quantity	
	f. Max cold oil temp. to bearing	
	g. Guaranteed life in Hrs	
	h. Lubrication type	
4.	Oil pressure gauge/ switch	
	a. Range	
	b. Contact Nos. & ratings	
	c. Accuracy	
5.	Type of cooler (CACA/CACW)/ Number	
6.	Cooling water requirements	
	a. Quantity required	
	b. Maximum permissible inlet water temp. in deg.C	
	c. Pressure of water at inlet to coolers	
	d. Outlet temperature of water at full load	
	e. Cold air temp. at outlet	
7.	Paint shade	
8.	Max. permissible temperature of rotor (deg.C)	
9.	Temp. Rise of rotor during 1st start (deg.C)	
10.	Temp. rise of rotor during 2nd start (deg.C)	
11.	Surge withstand voltage (stator winding) as per IEC-	

	a. Lightning impulse withstand level (1.2/50 micro sec surge)(KVp)	
	b. Interturn insulation surge withstand level (KVp)	
12.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
D.	**List of accessories.**	
1.	RTDs for winding(Type/Nos/Leads/Location/make/Res.at 0 Deg.C)	
2.	RTDs for bearing(Type/Nos/Leads location/make/Res.at 0 Deg.C)	
3.	RTDs for Hot Air (Type/No/Leads)	
4.	RTDs for Cold Air (Type/No./Leads)	
5.	Space Heaters	
	i) Nos.	
	ii) Total Power (Watts)	
	iii) Supply Voltage	
6.	Stator Terminal Box	
	i) Type	
	ii) Fault Level (MVA)/Fault Level duration (secs)	
	iii) Location(viewed from NDE side)	
	iv) Entry of cables (bottom/side)	
	v) Recommended cable size(To be matched with cable size envisaged by owner)	
7.	Cable glands & lugs details (shall be suitable for power cable)	
8.	Neutral Terminal box Type	

9.	Current Transformer	
	i) Nos.	
	ii) Ratio	
	iii) Accuracy Class	
	iv) Knee Point Voltage-Vk (Volts)	
	v)Exciting Current	
	vi) Max Secondary Resistance	
10.	Dial Type Thermometer	
	i) For Bearings (Nos.)	
	ii) For Air Temp (Nos.)	
	a. Hot Air	
	b. Cold Air	
	iii) Contact Rating	
	iv) Range	
	v) Supply Votlage	
11.	Rotor Terminal Box	
12.	TBs for RTDs. BTDs & Space Heater (Yes/No)	
13.	Sole Plate (Yes/No)	
14.	Foundation & Anchoring bolts (Yes/No)	
15.	Base Frame (Yes/No)	
16.	Speed switch (Yes/No)	
	i) No of contacts and contact ratings of speed	
17.	Insulation of bearing (Yes/No)	
18.	Forced oil lubrication (Yes/No)	
19.	Oil level indicator (Yes/No)	
20.	Noise reducer(Yes/No)	
21.	Flow switch for CACW motor (Quantity)	
	i) No of contacts and contact ratings	
22.	Water leakage detector	

	i) No of contacts and contact ratings	
23.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
24.	Vibration pads	
	i) Nos and size	
	ii) Location	
25.	Any other fitments	
E.	**List of curves.**	
1.	Torque speed characteristic of the motor	
2.	Calibration characteristic of platinum type resistance temperature detector	
3.	Calibration characteristic of platinum BTD	
4.	Thermal withstand characteristic	
5.	Starting. current Vs. Time	
6.	Starting. current Vs speed	
7.	Neg. sequence current vs Time..	
8.	P.F. and Effi. Vs Load	

DE-1B	**LT MOTORS**	
A.	**GENERAL**	
5.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
6.	Equipment driven by motor	
7.	Motor type	
8.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
18.	Frame size	
19.	Type of duty	
20.	Type of enclosure /Method of cooling/ Degree of	
21.	Applicable standard to which motor generally	
22.	Efficiency class as per IS 12615	
23.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per IS:2148	
24.	Type of mounting	
25.	Direction of rotation as viewed from DE END	
26.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
27.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
28.	Maximum continuous load demand of driven	
29.	Rated Voltage (volts)	

30.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
31.	Rated speed at rated voltage and	
32.	At rated Voltage and frequency:	
	a. Full load current	
	b. No load current	
33.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
34.	Efficiency at rated voltage and frequrecy,	
	a.100% load	
	b. 75% load	
	c. 50% load	
35.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
36.	Minimum permissible starting Voltage (Volts)	
37.	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
38.	Safe stall time with 100% and 110% of rated	
	a. From hot condition	
	b. From cold condition	
39.	Torques :	
	a. Starting torque at min. permissible voltage(kg-	

	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e.Rated torque (kg.m)	
40.	Stator winding resistance per phase (ohms at 20	
41.	GD^2 value of motors	
42.	No of permissible successive starts when motor is in hot condition	
43.	Locked Rotor KVA Input	
44.	Locked Rotor KVA/KW	
45.	Vibration limit :Velocity (mm/s)	
46.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size(To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	

	f. Cable glands & lugs details (shall be suitable for	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
D.	**List of accessories.**	
1.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No)	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Vibration pads	
	i) Nos and size	
	ii) Location	
8.	Any other fitments	
E.	**List of curves.**	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	
3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	

F.	Additional Data to be filled for each rating of DC Motor	
1.	Rated armature voltage (Volt)	
2.	Rated field excitation (Amp)	
3.	Permissible % variation in voltage	
4.	Minimum Permissible Starting voltage (volt)	
5.	At rated voltage	
	i)Full load Armature current.(Amp)	
	ii)Full load Field current (Amp)	
	iii)No load Armature current (Amp)	
6.	Full load Field current (Amp)	
7.	No load Aramature current (Amp)	
8.	Minimum permissible field current(Amp) to avoid	
	i) Maximum permissible voltage	
	ii) Rated voltage	
	iii) Minimum Permissible Voltage	
9.	Resistance (indicative Values) in ohm	
	i)Armature winding(Arm + IP + Series) at 25	
	ii) Field Winding at 25 deg. C	
10..	Inductance (indicative values)	
	i) Armature winding	
	ii) Field winding	
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
	i) 220 V DC	
	ii) 250 V DC	
	iii) 187 V DC	

12	Value of the external resistance (ohm)required to be connected in series with armature during starting only	
13	Technical data sheet for external resistance box	
14	GA drawing of motor	
15	Starting time calculation	
16	Starter resistance design calculation	
17	Electrical connection diagram of motor	

SUB-SECTION - DB2

BUSDUCTS

CLAUSE NO.	BIDDER'S NAME:	

MV BUSDUCT

Sl. No.	MEDIUM VOLTAGE BUSDUCTS	UNIT	VOLTAGE RATING
1	Manufacturer's Name Address		
2	Type of Busduct (segregated/Non-segregated)		
3	Continuous current rating(Amp) at 50^0C ambient	**Amps.**	
4	Short time current rating….KA for 1 sec.	**kA for 1 s**	
5	Dynamic current rating KA(peak)	**kA(peak)**	
6	Temperature rise over an ambient of 50^0C while carrying continuous current		
a	Bus Bar	**°C**	
b	Bus enclosure	**°C**	
7	One minute power frequency withstand voltage (KV)		
a	Dry	**kV**	
b	Wet	**kV**	
c	Impulse test withstand voltage with 1.2/50 microsecond wave (KV peak)	**kV**	

Sl. No.	MEDIUM VOLTAGE BUSDUCTS	UNIT	VOLTAGE RATING
8	**Conductor**		
a	Material		
b	Shape and cross section		
c	Type and joints (Plain/tinned/silver plated)		
d	Recommended bolt torque for conductor joints		
e	Conductor treatment (painting)		
9	**Enclosure**		
a	Material		
b	Shape		
c	Size		
d	Thickness(mm)	**mm**	
10	**Barrier**		
a	Material		
b	Thickness	**mm**	
11	**Support Insulator**		
a	Make & Type		
b	Material		
c	Reference Standard		
d	Cantilever strength	**kg**	
e	Number per support		
f	Voltage class	**kV**	

Sl. No.	MEDIUM VOLTAGE BUSDUCTS	UNIT	VOLTAGE RATING
g	Minimum Creepage distance	**mm**	
h	Weight	**kg**	

12	**Seal off bushings**		
a	Make & Type		
b	Material		
c	Voltage class(KV)	**kV**	
d	Compression strength (Kg.)	**kg**	
e	Min. creepage distance(mm)	**mm**	
f	Weight	**kg**	
g	Average Weight of Busduct	**kg/m**	

13	**Minimum clearances**		
a	Phase to earth	**mm**	
b	3-phase loss (watt/m) at rated current under site conditions	**watt/m**	

CLAUSE NO.	BIDDER'S NAME:	

SUB-SECTION - DB3

LT POWER CABLE

TECHNICAL DATA SHEETS

SUB-SECTION	TITLE
I	TECHNICAL INFORMATION & DATA TO BE SUBMITTED WITH THE PROPOSAL
II	TECHNICAL INFORMATION & DATA TO BE SUBMITTED AFTER THE AWARD OF CONTRACT

SUB-SECTION - I

TECHNICAL INFORMATION AND DATA

TO BE SUBMITTED

WITH THE PROPOSAL

1.00.00 Bidder shall give the details of his previous experience for the similar supplies made by him till this date.

2.00.00 **TECHNICAL LITERATURE**

2.01.00 The following technical particulars shall be submitted by the Bidder alongwith his proposal as separate appendices to the proposal:

3.00.00 **TECHNICAL DATA**

The following technical data shall be submitted by the bidder for each type and size of the cable, alongwith his proposal:

1. Make : ……..
2. Country of Manufacturer : ……..
3. Type Designation : ……..
4. Applicable Standard : ……..
5. Cable size : ……..
6. Rated voltage : ……..
7. Continuous current rating for max. conductor temperature:
   a. When laid in air at an ambient temp. of 50 ºC : ……..
   b. When buried in soil having thermal resistivity of 150 ºC Cm/W at a depth of 1000 mm in ground amb. Temp. of 40 ºC. : ……..
8. Short circuit withstand capacity and duration for
   a. Conductor : ……..

	b. Armour	:	……
	9. **Conductor**		
	a. Material	:	……
	b. Nominal cross section area in sq. mm.	:	……
	c. Max. D. C. resistance at 20 ºC	:	……
10.	**Insulation**		
	a. Material	:	……
	b. Nominal thickness (in mm)	:	……
	c. Identification of cores	:	……
11.	Material and Type of filler material (if required)	:	……
12.	Material and Type of inner sheath (if required)	:	……
13.	**Armour**		
	a. Material & shape	:	……
14.	**Outer sheath**		
	a. Material	:	……
	b. Colour	:	……
15.	Overall dia. of cable (in mm)	:	……
16.	Weight per 1000 metre (in Kg.)	:	……
17.	Standard drum length offered	:	……

SUB-SECTION - II

TECHNICAL INFORMATION & DATA TO BE

SUBMITTED AFTER THE AWARD OF CONTRACT

1.0 The following Technical Data, Drawings & Test certificates shall be submitted by successful bidder. The actual schedule of submission of these data/drawings/test reports shall be mutually discussed and agreed to between the Employer and successful bidder before the issue of Award of contract.

1.1 **Technical Particulars and Drawings**

a) Sectional drawings of cables

b) Approx. weight of metallic and non metallic items of each cable size

- Metallic (Kgs/Km)
- Non Metallic (Kgs/Km)

c) Rating factors for variation in ambient air temp

d) Rating factors for variation in amb. ground temp

e) Rating factors for variation in depth of laying in ground

f) Rating factors for variation in thermal resistivity of soil

g) Grouping factors for cables laid in open air racks

h) Grouping factors for cables laid in built Up concrete trenches with restricted air circulation

i) Grouping factors for cables laid in ground

j) Particulars of cable drums

k) Grouping factors for cables laid in ducts/pipes

1.2 **Test Certificates**

	Complete test reports including type tests, routine tests and acceptance tests.
1.3	**Instruction manual** for storage for prolonged duration, unpacking, handling at site, erection, pre-commissioning test etc.
1.4	**Technical Data**
1.4.1	The following technical data shall be submitted by the contractor for each type and size of the cable for employer's approval.

1. Make : ……

2. Country of manufactuer : ……

3. Type designation : ……

4. Applicable standard : ……

5. Cable size (No. of cores x mm^2) : ……

6. Rated voltage : ……

7. Continuous current rating for maximum conductor temp. when laid in air at ambient of 50 ºC

   a) When metallic armour is earthed at one end (amps) : ……

   b) For unarmoured Cables (Amps) : ……

8. Continuous current rating for max. conductor temp. when buried in soil having thermal resistivity of 150 ºC Cm/N at a depth of 1 mt. at ground ambient temp. of 40 º C.

   a) When armour is earthed at one end (Amps) : ……

   b) For unarmoured Cables (Amps) : ……

9. **Short circuit withstand capacity and duration for**

a) Conductor : ……

b) Armour : ……

10. **Conductor**

a) Material : ……

b) Grade : ……

c) Nominal cross sectional area (Sq. mm)

d) Number and diameter of wires Before compacting of conductor Strands

i) No. of wires (min.)

ii) Dia. Of each wire in mm (min.): ……

e) Shape of conductor : ……

f) Diameter over conductor (mm) : ……

i) Fictitious : ……
(as per IS 10462 (part-1-1983)

ii) Approximate : ……

g) Direction of lay of stranded layer : ……

h) Conductor resistance (DC)

at 20 ºC ohm/Km (max) : ……

11. **Conductor resistance (AC)**

a) at 20 ºC ohm/Km : ……

b) at 90 ºC in ohm/Km : ……
(for XLPE Cables)

c) at 70 ºC. in ohms/KM : ……
(for PVC Cables)

12. Reactance per phase at 50 Hz in ohm/km : ……

13.	Capacitance at 50 hz in micro Farads/Km		
14.	**Insulation**		
	a) Material and Type of insulation	:	……
	b) Nominal thickness of insulation (mm)	:	……
	c) Tolerance on thickness of insulation (mm)	:	……
	d) Filled or unfilled (for XLPE only)		
	e) Type of curing (for XLPE only)	:	……
	f) Min. volume resistivity at - 27 ºC (Ohm-cm)	:	……
	- 70 ºC (Ohm-cm) (for PVC only)	:	……
	- 90 ºC (Ohm-cm (for XLPE only)	:	……
	g) Identification of cores	:	……
15.	**Inner sheath**		
	a) Material and Type	:	……
	b) Diameter over the laid up cores (mm)	:	……
	i) Calculated (By fictitious Calculations as per IS 10462 (part-1) 1983)	:	……
	ii) Approximate	:	……
	c) Thickness of inner sheath (Min) (mm)	:	……
	d) Colour of inner sheath	:	……
	c) Tolerance in thickness of Inner sheath (mm)	:	……
16.	Material and Type of filler	:	……

17. **Armour (in case of armoured cables)**

a) Material and Type of armour : ……

b) Shape : ……

c) Diameter of cable over inner-sheath (under armour) mm : ……

i) Calculated : ……
(By Fictitious calculations as per IS 10462 (part-1) 1983

ii) Approximate : ……

d) Dimension of formed wire/wire in mm : ……

e) No. of armour formed wires/wires : ……

f) Approx. cross sectional area of armour (Sq. mm) : ……

g) Max. Resistivity of armour formed wire/ wire at 20ºC (ohm/km) : ……

h) Direction of lay of armour : ……

18. Voltage developed in the armour per 100 mt. run with armour earthed at one end, when cable is carrying (for single core cables only)

a) Rated current (Volts) : ……

b) Short circuit current (Volts) : ……

19. **Outer sheath**

a) Material and Type : ……

b) Diameter under the outer sheath (mm) : ……

i) Calculated : ……
(By fictitious Calculations as per IS 10462 (part-1) 1983)

ii) Approximate : ……

	c) Nominal thickness of outer sheath (mm)	: ……
	d) Tolerance on Nominal thickness of outer sheath (mm)	: ……
	e) Colour of outer sheath	: ……
20.	Guaranteed value of min. oxygen index of outer sheath :	……
21.	Max. acid gas generation by weight (%):	……
22.	Maximum smoke density rating (%)	: ……
23.	a)Overall diameter of cable (mm) :	……
	b)Tolerance on overall diameter (mm) :	……
24.	Weight per 1000 mtrs (Kg)	: ……
25.	Recommended min. installation radius (mm) :	……
26.	Safe pulling force when pulled by pulling eye on the conductor (N)	: ……
27.	**Cable Drums**	
	a) Type (Wooden/steel)	: ……
	b) Dimensions (Approx)	: ……
	i) Flange diameter (mm)	: ……
	ii) Barrel diameter (mm)	: ……
	iii) Traverse (mm)	: ……
28.	Weight of cable drum with cable (Kgs) :	……
29.	Max./standard length per drum for each size of cable (single length	

with tolerance) (m) (%) : ……

SUB-SECTION - DB4

LT CONTROL CABLES

TECHNICAL DATA SHEETS

SUB-SECTION	TITLE
I	TECHNICAL INFORMATION & DATA TO BE SUBMITTED WITH THE PROPOSAL
II	TECHNICAL INFORMATION AND DATA TO BE SUBMITTED AFTER THE AWARD OF CONTRACT

CLAUSE NO.	Bidder's Name ……..

SUB-SECTION - I

TECHNICAL INFORMATION AND DATA

TO BE SUBMITTED WITH THE PROPOSAL

1.00.00 Bidder shall give the details of his previous experience for the similar supplies made by him till this date.

2.00.00 **TECHNICAL LITERATURE**

2.01.00 The following technical particulars shall be submitted by the Bidder alongwith his proposal as separate appendices to the proposal:

3.00.00 **TECHNICAL DATA**

The following technical data shall be submitted by the bidder for each type and size of the cable, alongwith his proposal:

1. Make : ……..
2. Country of Manufacturer : ……..
3. Type Designation : ……..
4. Applicable Standard : ……..
5. Cable size : ……..
6. Rated voltage : ……..
7. Continuous current rating for max. conductor temperature:

a. When laid in air at an ambient temp. of 50 º C : ……..

b. When buried in soil having thermal resistivity of 150 º C Cm/W at a depth of 1000 mm at ground amb. Temp. of 40 º C. : ……..

8. Short circuit withstand capacity and duration for

   a. Conductor : ……..

   b. Armour : ……..

9. **Conductor**

a. Material : ……

b. Nominal cross section area in sq. mm. : ……

c. Maximum D. C. resistance at 20 º C : ……

10. **Insulation**

a. Material : ……

b. Nominal thickness (in mm) : ……

c. Identification of cores : ……

11. Material and Type of filler material : ……

12. Material and Type of inner sheath material : ……

13. **Armour**

a. Material type : ……

14. **Outersheath**

a. Material : ……

b. Colour : ……

15. Overall dia. of cable (in mm) : ……

16. Weight per 1000 metre (in Kg.) : ……

17. Standard drum length offered : ……

SUB-SECTION - II

TECHNICAL INFORMATION & DATA TO BE

CLAUSE NO.	Bidder's Name ……..

SUBMITTED AFTER THE AWARD OF CONTRACT

1.0 The following Technical Data, Drawings & Test certificates shall be submitted by successful bidder to the employer. The actual schedule of submission of these data/drawings/test reports shall be mutually discussed and agreed to between the Employer and successful bidder before the issue of Award of contract.

1.1 **Technical Particulars and Drawings**

a) Sectional drawings of cables

b) Core identification details of control cables

c) Approx. weight of metallic and non metallic Items of each cable size.

- Metallic (Kg/Km)
- Non Metallic (Kg/Km)

d) Rating factors for variation in ambient air temp

e) Rating factors for variation in in ambient ground temp

f) Rating factors for variation in depth of laying in ground

g) Rating factors for variation in thermal resistivity of soil

h) Grouping factors for cables laid in open air racks

i) Grouping factors for cables laid in built up concrete trenches with restricted air circulation

j) Grouping factors for cables laid in ground

k) Grouping factors for cables laid in ducts/pipes

1.2 **Test Certificates**

Complete test reports including type tests, routine tests and acceptance

	tests.		
1.3	**Instructional manual** for storage for prolonged duration, unpacking, handling at site, erection, pre-commissioning test etc.		
1.4	**Technical Data**		
1.4.1	The following technical data shall be submitted by the contractor for each type and size of the cable for Employer's approval.		
1.	Make : ……		
2.	Country of manufacturer	:	……
3.	Type designation	:	……
4.	Applicable standard	:	……
5.	Cable size (No. of cores x mm2)	:	……
6.	Rated voltage	:	……
7.	Continuous current rating for maximum conductor temp. when laid in air at ambient of 50 º C		
	a) When armour is earthed at one end (amps)	:	……
	b) For unarmoured Cables (Amps)	:	……
	8. Continuous current rating for max. conductor temp. when buried in soil having thermal resistivity of 150 º C Cm/N at a depth of 1 m at ground ambient temp. of 40 ºC.		
	a) When armour is earthed at one end (Amps)	:	……
	b) For unarmoured Cables (Amps)	:	……
	9. **Conductor**		
	a) Material	:	……

	b)	Grade	: ……
	c)	Nominal cross sectional area (Sq. mm)	
	d)	Number and diameter of wires before compacting of conductor strands	
		i) No. of wires (min.)	
		ii) Dia. of each wires in mm (min.)	: ……
	e)	Shape of conductor	: ……
	f)	Diameter over conductor (mm)	: ……
		i) Fictitious (as per IS 10462 (part-1)-1983)	: ……
		ii) Approximate	: ……
	g)	Direction of lay of stranded layer	: ……
	h)	Conductor resistance (DC) at 20 deg. C ohm/Km (max)	: ……
10.	**Conductor resistance (AC)**		
	a)	at 20 deg. C ohm/Km	: ……
	b)	at 70 deg. C. in ohms/Km	: ……
11.	Reactance per phase at 50 Hz in ohm/km		: ……
12.	Capacitance at 50 Hz in micro Farads/Km		
13.	**Insulation**		
	a)	Material and Type of insulation	: ……
	b)	Nominal thickness of insulation (mm)	: ……
	c)	Tolerance on thickness of insulation (mm)	: ……
	e)	Min. volume resistivity at 20 deg. C (Mega Ohm/Km)	: ……

	f) Identification of cores	: ……
14.	**Innersheath**	
	a) Material & Type	: ……
	b) Diameter over the laid up cores (mm)	: ……
	i) Calculated (By fictitious Calculations as per IS 10462 (part-1) 1983)	: ……
	ii) Approximate	: ……
	c) Thickness of innersheath (Min) (mm)	: ……
	d) Colour of sheath	: ……
	e) Tolerance in thickness of Inner sheath (mm)	: ……
15.	Material and Type of filler	: ……
16.	**Armour (in case of armoured cables)**	
	a) Material and Type of armour	: ……
	b) Shape :	……
	c) Diameter of cable over inner-sheath (under armour) mm	: ……
	i) Calculated (By fictitious calculations as per IS 10462 (part-1) 1983)	: ……
	ii) Approximate	: ……
	d) Dimension of formed wire/wire in mm	: ……
	e) No. of armour formed wires/wires	: ……
	f) Approx. cross sectional area of armour (Sq. mm)	: ……
	g) Max. Resistivity of armour formed wire/wire at 20 deg. C (ohm/km)	: ……
	h) Direction of lay of armour	: ……
17.	**Outersheath**	

	a) Material and type	: ……
	b) Diameter under the sheath (mm)	: ……
	i) Calculated (By fictitious Calculations as per IS 10462 (part-1) 1983)	: ……
	ii) Approximate	: ……
	c) Nominal thickness of sheath (mm)	: ……
	d) Tolerance on Nominal thickness of outer sheath (mm)	: ……
	e) Colour of outer sheath	: ……
18.	Guaranteed value of min. oxygen index of outer sheath	: ……
19.	Max. acid gas generation by weight (%)	: ……
20.	Maximum Smoke Density rating (%)	: ……
21.	a) Approx. overall diameter of cable (mm)	: ……
	b) Tolerance on overall diameter (mm)	: ……
22.	Weight per 1000 mrs (Kg) with a tolerance of ± 10%	: ……
23.	Recommended min. installation radius (mm) :	……
24.	Safe pulling force when pulled by pulling eye on the conductor (N)	: ……
25.	**Cable Drums**	
	a) Type (Wooden/steel)	: ……
	b) Dimensions (Approx)	: ……
	i) Flange diameter (mm)	: ……
	ii) Barrel diameter (mm)	: ……
	iii) Traverse (mm)	: ……
26.	Weight of cable drum with	

	cable (Kg) : ……
27.	Max./standard length per drum for each size of cable (single length with tolerance) (m) (%) : ……

SUB-SECTION - DB5

CABLING EARTHING & LIGHTNING PROTECTION

CLAUSE NO.	Bidder's Name ……..

CABLING

1.0 **CABLE TRAYS, FITTINGS & ACCESSORIES**

a) Maker's Name, Country of manufacture .....

b) Type & material of cable tray .....

c) Type of cable support system .....

d) Applicable standard .....

2.0 **JUNCTION BOXES**

a) Maker's Name & Country of Manufacture .....

b) Applicable Standard .....

c) Material .....

d) No of terminals .....

e) Degree of protection .....

3.0 **CABLE GLANDS**

a) Maker's name & Country of manufacture .....

b) Type of cable gland .....

c) Material .....

d) Applicable Standard .....

4.0 **CABLE JOINTING/TERMINATION KITS**

a) Maker's Name & Country of manufacture .....

b) Type of system

i) Termination H.T./L.T. .....

ii) Joints H.T./L.T. .....

c) Outdoor/Indoor .....

SUB-SECTION - DB6

LT SWITCHGEAR

LT Switchgears & LT Busducts
PART-I

TECHNICAL INFORMATION AND DATA TO BE SUBMITTED WITH THE PROPOSAL

SWITCHGEAR & MCC

a) General

i) Manufacturer's Name .....

ii) Type designation .....

iii) Country of origin .....

b) Rated voltage .....

c) Symmetrical short circuit withstand current at rated voltage of switchgear /MCC cubicle. .....

PART-II

TECHNICAL INFORMATION AND DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT

1.00.00 SWITCHGEAR & MCC

a) General

i) Manufacturer's Name .....

ii) Type designation .....

iii) Country of origin .....

b) Rated voltage .....

c) Symmetrical short circuit withstand current at rated voltage of switchgear /MCC cubicle. .....

d) Peak short circuit withstand current .....

e) Rated current at ambient .....

f) Degree of protection as per IS:13947

i) Breaker / MCC cubicles .....

ii) Busbar chamber .....

g) Cubicle sheet metal details

i) Cold rolled / hot rolled .....

ii) Thickness, structural & load bearing members .....

iii) Thickness, front & rear .....

iv) Thickness, Sides & top .....

v) Thickness of gland plates .....

h) Painting shade & Thickness as per IS :5

i) External surfaces(front & rear) .....

ii) Extreme end covers .....

i) Minimum Clearance in air for Busbars

i) Between phases .....

ii) Between phase & earth .....

j) Standard height, width & depth of typical panel

		i) Circuit breaker panel	.....
		ii) MCC panels (S.F./D.F.)	.....
		iii) Circuit breaker panel with Bus trunking /Bus Duct Termination	.....
		iv) ACDB/DCDB	.....
		v) AC/DC Fuse boards	.....
	k)	Width of cable alley	.....
	l)	Shrouding arrangement in cable alley provided or not	YES/NO
	m)	Earth busbar size & material	.....
	n)	Approx. Weight of one panel With circuit breaker	.....
	o)	Recommended dynamic loading for foundation design	.....
	p)	Approx. weight of one MCC panel	.....
	q)	Form of Internal Separation as per IEC-61439-2	.....
2.00.00	**POWER BUSBARS & INSULATORS**		
	a)	Material & applicable standards	.....
	b)	Bare/painted / epoxy insulated/sleeved	.....
	c)	Continuous current rating at an ambient temp. of 50^0C	.....
	d)	Temperature rise over design ambient temperature for continuous current rating deg. C	.....
	e)	Material of the support insulators	.....
	f)	One second current rating (kA)	.....
3.00.00	**CONTROL SUPPLY TRANSFORMER**		
	a)	Make	.....
	b)	Type	.....
	c)	Material & class of insulation	.....
	d)	Voltage rating & taps	.....
	e)	Continuous rating (VA)	.....
4.00.00	**CIRCUIT BREAKER**		
	a)	Manufacturer's name and country of manufacturer	.....
	b)	Manufacture's type and designation	.....

	c)	Rated Voltage	.....
	d)	Rated operating duty	.....
	e)	Design ambient temperature	.....
	f)	Rated current at design ambient temperature	.....
	g)	Derating factor for site operating conditions inside panel	.....
	h)	Continuous current at ambient temp.	.....
	i)	Rated symmetrical breaking current	.....
	j)	Rated peak making current	.....
	k)	Rated short time rating (for 1 sec.)	.....
	l)	Rated peak momentary rating	.....
	m)	Number of openings, the circuit breaker is capable of performing without inspection, replacement of contacts or other parts at 100% rated breaking current	.....
	n)	No. of breaker auxiliary contacts provided on fixed portion of breaker & their rating	.....
	o)	Trip free and anti pumping features have been provided (Furnish description)	YES/NO
	p)	Power operating mechanism	.....
	q)	Spring charging motor details	
		i) Type	.....
		ii) Rating Watts	.....
		iii) Rated voltage	.....
		iv) Class of insulation	.....
		v) Time for fully charging the closing spring	.....
	r)	Emergency Manual charging facility provided	YES/NO
	s)	Limits of voltage for satisfactory operation of the following devices as percentage of normal voltage	
		i) Motor	.....
		ii) Closing coil	.....
		iii) Tripping coil	.....
	t)	Manual operating mechanism	.....
	u)	i) Type of Releases provided	.....
		ii) Available range of following parameters for each type of release offered	.....

	v) i) Maximum Tripping Time	.....
	ii) Maximum Closing time	.....
	w) i) Closing coil VA	.....
	ii) Tripping coil VA	.....
	x) Telescopic trolley	
	i) Make	.....
	ii) Type designation	.....
	iii) Dimensions	.....
5.00.00	**AIR BREAK SWITCHES**	
	(The following details shall be furnished for each type & rating)	
	a) Make	.....
	b) Type	.....
	c) Applicable standards	.....
	d) Rated current at design ambient temperature (Amps)	.....
	e) Design ambient temperature Deg C	.....
	f) Rated breaking current (kA)	.....
	g) Maximum through fault current withstand kA	.....
	h) Door interlock as specified has been provided ?	YES/NO
	i) No. of auxiliary contacts and its rating	.....
6.00.00	**CONTROL/SELECTOR SWITCH**	
	a) Make	.....
	b) Type Designation	.....
	c) Voltage grade	.....
7.00.00	**CONTACTOR**	
	(The following details shall be furnished for each type and rating)	
	a) Make	.....
	b) Type & applicable standards	.....
	c) Rated voltage of main and auxiliary contacts	.....

	d) Rated voltage of coils	.....
	e) Limits of operation	
	i) Supply voltage variation +/-%	.....
	ii) Supply frequency variation for closing (+/-)%	.....
	iii) Drop out voltage %	.....
	f) Rated (thermal) current A	.....
	g) Rated duty	.....
	h) Rated utilisation category as per IS:13947	.....
	i) Rated breaking capacity kA	.....
	j) Rated making capacity - kA	.....
	k) Coil VA burden	.....
8.00.00	**AUXILIARY CONTACTOR**	
	a) Make	.....
	b) Type	.....
	c) Catalogue attached as Annexure No.	.....
9.00.00	**FUSES**	
	a) Make	.....
	b) Type	.....
	c) Category	.....
10.00.00	**CURRENT TRANSFORMERS**	
	(The following details shall be provided for each type & rating)	
	a) Make	.....
	b) Applicable standards	.....
	c) Ratio	.....
	d) VA Rating	.....
	e) Accuracy class	.....
	f) Class & type of insulation	.....
11.00.00	**VOLTAGE TRANSFORMERS**	

	a) Make	.....
	b) Ratio	.....
	c) VA Rating	.....
	d) Accuracy class	.....
	e) Over voltage factor	.....
	f) Class & type of insulation	.....
12.00.00	**Numerical relays**	
	a) General Technical Details and Drawings Enclosed	.....
	b) Make/Model No	.....
	c) Place of Manufacture	.....
	d) Hardware version number	.....
	e) Firmware version number	.....
	f) Rated Voltage Vn (phase-to-neutral)	.....
	g) Rated Current In	.....
	h) Rated Frequency	.....
	i) Over voltage capability - continuous	.....
	j) Over voltage capability – 3s	.....
	k) Burden on voltage transformers (VA per phase)	.....
	l) Over current capability - continuous	.....
	m) Over current capability – 1s	.....
	n) Burden on current transformers (VA per phase)	.....
	o) Reference standards	.....
	p) Operating principle	.....
	q) No Of communication Ports	.....
	r) Compliance to IEC-61850	.....
	s) Built-in functions provided in the relay (list out)	.....
	t) Protection Functions	.....
	u) Measurements	.....

	v) Monitoring Functions .....
	w) Control functions .....
	x) Detailed Technical Catalogue for offered Relays enclosed .....
	y) Spares and Repairs
	a) State availability of spares in country and spares holding in country of origin .....
	b) Maximum repair turnaround time .....
	c) Define the proposed repair strategy .....
	d) Recommended spares list .....
	z) List of reference sites in operation for more than 1 year .....
13.00.00	**THERMAL OVERLOAD RELAY & SINGLE PHASING PREVENTER**
	(The following details shall be furnished for each type & rating)
	a) Make & type designation .....
	b) Catalogue .....
14.00.00	**VOLTMETER**
	a) Make .....
	b) Type .....
	c) Catalogue .....
15.00.00	**AMMETER**
	a) Make .....
	b) Type .....
	c) Catalogue .....
16.00.00	**PUSH BUTTONS**
	a) Make .....
	b) Type designation .....
	c) Catalogue .....
17.00.00	**INDICATING LAMPS**
	a) Make .....
	b) Type .....

	c) Catalogue	.....
18.00.00	**LOCAL STARTERS**	
	a) Make & Type	.....
	b) Catalogue	.....
19.00.00	**415 V NON SEGREGATED BUSDUCTS**	
	a) Manufacturer's name & address	.....
	b) Type of busduct	.....
	c) Material and cross section of busbars	.....
	d) Rated voltage (volts)	.....
	e) Maximum voltage at which busduct can operate continuously (volts)	.....
	f) Continuous current rating of busbars (Amps)	.....
	g) Short circuit current ratings & duration (kA /Sec)	.....
	h) Momentary current rating kA peak	.....
	i) Temperature rise over the ambient temperature	
	i) Busbars	.....
	ii) Enclosures	.....
	j) Material of support insulator	.....
	k) No. and arrangement of support insulators	.....
	l) Material of Gaskets	.....
	m) One minute power frequency withstand voltage (kV)	.....
	n) Minimum creepage distance over insulator (mm)	.....
	o) Conductor treatment	.....
	p) Clearance (mm)	.....
	i) Phase to Phase	.....
	ii) Phase to earth	.....
	q) Average weight per meter of busduct (kg)	.....
	r) Material and thickness of Busduct	.....
	s) Shape & size of enclosure	.....

CLAUSE NO.	DATA REQUIREMENTS	
20.00.00	**LIGHTING / WELDING TRANSFORMERS**	
	a) Make	.....
	b) Voltage Ratio	.....
	c) kVA Rating	.....
	d) Vector Group	.....
	e) Type of Cooling	.....
	f) Percentage impedance	.....
	g) Details of taps provided	.....
	h) Class of insulation	.....
	i) Degree of protection for enclosure	.....
	j) Whether mounted inside MLDB or outside	.....
	k) If it is mounted outside dimension of the enclosure	.....
21.00.00	**MCCB**	
	a) Rated voltage	
	b) Rated insulation level	.....
	c) Rated ultimate &Service S.C.breaking capacity	.....
	d) Rated making capacity	.....
	e) Utilization category	.....
22.00.00	**Ethernet switches (For Networking of Numerical Relays)**	
	a) Compliance to IEC 61850	.....
	b) No of Ports	.....
	c) Power supply to Ethernet Switches	.....

SUB-SECTION – DB7

HT POWER CABLE

TECHNICAL DATA SHEETS

SUB-SECTION	TITLE
I	TECHNICAL INFORMATION & DATA TO BE SUBMITTED WITH THE PROPOSAL
II	TECHNICAL INFORMATION & DATA TO BE SUBMITTED AFTER THE AWARD OF CONTRACT

SUB-SECTION – I

(HT CABLES)

TECHNICAL INFORMATION & DATA TO BE SUBMITTED

WITH THE PROPOSAL

1.00.00 Bidder shall give the details of his previous experience for the similar supplies made by him till this date.

2.00.00 **TECHNICAL LITERATURE**

2.01.00 The following technical particulars shall be submitted by the Bidder alongwith his proposal as separate appendices to the proposal :

a) Type test certificates for cables including those for FRLS properties.

3.00.00 **TECHNICAL DATA**

The following technical data shall be submitted by the bidder for each type and size of the cable, alongwith his proposal:

1. Make : ……
2. Country of Manufacturer : ……
3. Type Designation : ……
4. Applicable Standard : ……
5. Cable size : ……
6. Rated voltage : ……
7. Continuous current rating for max. conductor temp.

   a. When laid in air at an ambient temp. of 50 ºC : ……

   b. When buried in soil having thermal resistivity of 150 ºC Cm/W at a depth of 1000 mm and at ground amb. temp. of 40 ºC. : ……

8. Short circuit withstand capacity and duration for

   a. Conductor : ……

b. Screen : ……

c. Armour : ……

9. Conductor

a. Material : ……

b. Nominal cross section area in sq. mm. : ……

c. Max. DC resistance at 20 ºC : ……

10. Insulation

a. Material : ……

b. Nominal thickness (in mm) : ……

c. Identification of cores : ……

11. Metallic Screen (wherever applicable)

a. Material & type : ……

12. Type of filler material : ……

13. Type of inner sheath material : ……

14. Armour

a. Material & type : ……

15. Outer sheath

a. Material : ……

b. Colour : ……

16. Overall dia of cable (in mm) : ……

17. Weight per 1000 metre (in kg.) : ……

18. Standard drum length offered : ……

SECTION -II

HT CABLES

TECHNICAL INFORMATION & DATA TO BE SUBMITTED

AFTER THE AWARD OF CONTRACT

The following technical data, drawings and test certificates shall be submitted by successful bidder to the Employer. The actual schedule of submission of these data/drawings/test reports shall be mutually discussed and agreed to between the Employer and successful bidder before the issue of award contract.

1.1 **Technical Particulars and Drawings**

a) Sectional drawings of cables : ……

b) Approx. Weight of metallic and non metallic items of each cable size (Kgs)

Metallic (Kgs/Km) : ……

Non Metallic (Kgs/Km) : ……

c) Rating factors for variation in ambient air temp. : ……

d) Rating factors for vibration in amb. In ambient air temp. : ……

e) Rating factors for variation depth of laying in ground : ……

f) Rating factors for variation in thermal resistivity of soil : ……

g) Grouping factors for cables laid in open air racks : ……

h) Grouping factors for cables in build up concrete trenches with restricted air circulation : ……

i) Grouping factors for cables laid in ground : ……

j) Particulars of cable drums : ……

k) Grouping factors for cables laid

	in ducts/pipes	:	……
1.2	Test Certificates		
	Complete test reports including Type Tests, Routine tests and Acceptance Tests	:	……
1.3	Instruction manual for storage for prolonged duration, unpacking, handling at site, erection, pre-commissioning test etc.	:	……
1.4	Technical Data		
1.4.1	The following technical data shall be submitted by the contractor for each type and and size of the cable for Employer's approval.		
	1. Make	:	……
	2. Country of manufacturer	:	……
	3. Type designation	:	……
	4. Applicable standard	:	……
	5. Cable size (No. of Cores x mm2)	:	……
	6. Rated Voltage	:	……
	7. Continuous current rating for maximum conductor temp. when laid in air at ambient of 50 deg. C.		
	a) When metallic screen /armour is earthed at one end (Amps)	:	……
	b) When metallic screen/armour is earthed at both the ends (Amps)	:	……
	c) For unscreened, unarmoured Cables (Amps)	:	……
	8. Continuous current rating for max. conductor temp. when buried in soil having thermal resistivity of 150 deg. C Cm/N at a depth of		

1 mtr. and at ground ambient temp. of 40 deg. C.

a) When metallic screen / armour is earthed at one end (Amps) : ……

b) When metallic screen/ armour is earthed at both the ends (Amps) : ……

c) For unscreened, unarmoured cables (Amps) : ……

9. Short circuit withstand capacity and duration for :

a) Conductor : ……

b) Metallic screen : ……

c) Armour : ……

10. Conductor

a) Material (Copper or Aluminium) : ……

b) Grade : ……

c) Nominal cross sectional area (Sq. mm) : ……

d) Number and diameter of wire before compacting of conductor strands

i) No. of wires (min.) : ……

ii) Dia of wires in mm : ……

e) Shape of conductor : ……

f) Diameter over conductor (mm) : ……

i) Fictitious (as per IS 10462 (Part-1)-1983) : ……

ii) Approximate : ……

g) Direction of lay of stranded layers : ……

h) Conductor resistance (DC)

At 20 deg C in Ohm/Km (max.) : ……

i) Conductor resistance (AC)

a) at 20 deg. C ohm/Km (Approx) : ……

b) at 90 deg. C in ohm/Km (Approx) (for XLPE cables) : ……

j) Reactance per phase at 50 Hz in ohm/km : ……..

k) Capacitance at 50 hz in micro Farads / Km : ……..

l) Conductor screening (wherever applicable)

a) Material and type : ……..

b) Thickness of extruded layer (mm) : ……..

12. Insulation

a) Composition of insulation : ……..

b) Nominal thickness of insulation (mm) : ……..

c) Tolerance on thickness of Insulation (mm) : ……..

d) Filled or unfilled (for XLPE only) : ……..

e) Type of curing (for XLPE only) : ……..

f) Min. insulation resistance at 20 deg. C (Mega Ohm/Km) : ……..

g) Identification of cores : ……..

13. Insulation screening (wherever applicable : ……..

a) Material & type : ……..

b) Thickness of extruded layer (mm) : ……..

14. Metallic Screen

    a) Material : ……..

    b) Size of tape /wire (mm) : ……..

    c) No. of wires / tapes : ……..

    d) Short circuit capacity of metallic screen : ……..

    e) Cross sectional area of screen (sq. mm) : ……..

    f) Dia below metallic screen i.e. below copper tape/wire (mm) : ……..

15. Inner sheath

    a) Material : ……..

    b) Diameter over the laid up cores (mm)

        i) Calculated (By fictitius calculations as per IS 10462 (part-1)-1983) : ……..

        ii) Approximate : ……..

    c) Thickness of sheath (Min) (mm) : ……..

    d) Colour of sheath : ……..

    e) Tolerance in thickness of inner sheath (mm) : ……..

16. Type of filler material : ……..

17. Armour (in case of armoured cables)

    a) Type of material of armour : ……..

    b) Formed wire / wire : ……..

    c) Diameter of cable over inner sheath (under armour) mm

        i) Calculated : ……..

(By Fictitious calculations as per IS 10462 (part-1)-1983)

ii) Approximate : ……..

d) Dimension of formed wire / wire in mm : ……..

e) No. of armour formed wires /wires : ……..

f) Approx. cross sectional area of armour (Sq. mm) : ……..

g) Resistivity of armour wire at 20 deg. C (ohm- cm.) : ……..

h) Direction of lay of armour : ……..

18. Outer Sheath

a) Material and type : ……..

b) Diameter under the sheath (mm)

i) Calculated (By Fictitious calculations as per IS 10462 (part-1) - 1983) : ……..

ii) Approximate : ……..

c) Thickness of sheath (mm) : ……..

d) Tolerance on Nominal thickness of sheath (mm) : ……..

e) Colour of sheath : ……..

19. a) Overall diameter of cable (mm) : ……..

b) Tolerance on overall diameter (mm) : ……..

c) Eccentricity : ……..

d) Ovality : ……..

20. Weight per 1000 mtrs (Kg) : ……..

21. Recommended min installation

radius (mm) : ……..

22. Safe pulling force when pulled by pulling eye on the conductor (kg) : ……..

23. Cable Drums

a) Type (Wooden/steel) : ……..

b) Dimensions (Approx) : ……..

i) Flange diameter (mm) : ……..

ii) Barrel diameter (mm) : ……..

iii) Traverse (mm) : ……..

c) Weight of cable drum with Cables (Kgs) : ……..

24. Max. / standard length per drum for each size of cable (mtr.) and tolerance (%) : ……..

25. Guaranteed value of min. oxygen index of outer sheath : ……..

26. Max. acid gas generation by weight (%): ……..

27. Maximum smoke density rating (%) : ……..

28. Voltage developed in the screen/armour per 100 mt run with screen / armour earthed at one end when cables is carrying (for single core cables only)

a) Rated current (Volts) : ……..

b) Short circuit current (Volts)

i) in the screen : ……..

ii) in the armour : ……..

29. Circulating current developed in the

screen/armour for 100 mt. run, with screen/armour earthed at both ends when cable is carrying (for single core cables only)

a) Rated current(Amps) : ……..

b) Short circuit current (amps) : ……..

i) in the screen : ……..

ii) in the armour : ……..

SUB-SECTION – DB8

HT SWITCHGEAR

HT Switchgears

1.00.00 GENERAL PARTICULARS

a.	Manufacturer	:	.....
b.	Type designation	:	.....
c.	Catalogue attached as Annexure No.	:	.....
d.	Applicable standards	:	.....
e.	Rated voltage (kV)	:	.....
f.	Maximum system voltage (kV)	:	.....
g.	Power frequency withstand (one minute) voltage of the switchgear cubicle (kV)	:	.....
h.	Impulse withstand (1.2/50 micro sec.) Voltage (kVp)	:	.....
I.	Short circuit withstand current and duration at rated voltage of the switchgear cubicle (kA rms)	:	.....
j.	Dynamic current withstand rating kA (peak)	:	.....
k.	Degree of protection provided by the cubicle (i) VT/ Relay compartment (II) Other compartment	: 	....
l.	Minimum clearance in air of live parts (i) Between phases (mm.) (ii) Between earth (mm.)	: 	....
m.	Panel size (width x depth x height in mm)	:	.....
n.	Bus bar material Al. / Cu.	:	.....
o.	Bus bar size (in mm)	:	.....
p.	Continuous current rating and corresponding temperature rise	:	.....
q.	Material and size of earth bus	:	.....
r.	Service Continuity Classification	:	.....
s.	Internal ARC classification	:	.....
t.	Type test reports enclosed as Annexure no.	:	.....

2.00.00 CIRCUIT BREAKERS

a.	Manufacturer	:	.....
b.	Type designation	:	.....

	c.	Standard to which manufactured	:	.....
	d.	Catalogue attached as Annexure No.	:	.....
	e.	Type	:	.....
	f.	Rated voltage & frequency (kV, Hz.)	:	.....
	g.	Maximum system voltage (kV)	:	.....
	h.	Continuous current rating when the breaker is inside the panel and door closed over corresponding amb. temp. 50 deg.	:	.....
	I.	Making current (kA)	:	.....
	j.	One sec. current carrying capacity (kA)	:	.....
	k.	Power frequency withstand voltage for 1min. (kV)	:	.....
	l.	Impulse withstand voltage for 1.2/50 micro sec. full wave (kV peak)	:	.....
	m.	Duty cycle for breaking capacity (O-3min-CO-3min-CO)	:	.....
	n.	Minimum clearance (i) Between poles (mm.) (ii) In insulating medium between live parts & earth (mm)	:	....
	o.	Circuit breaker closing time	:	.....
	p.	Circuit breaker breaking time	:	.....
	q.	Type test report enclosed as Annexure No.	:	.....
3.00.00	**CONTACTOR**			
	a.	Manufacturer	:	.....
	b.	Type designation	:	.....
	c.	Standard to which manufactured	:	.....
	d.	Catalogue attached (Annexure-I)	:	.....
	e.	Type	:	.....
	f.	Utilization Category	:	.....
	g.	Rated voltage & frequency (kV, Hz)	:	.....
	h.	Maximum system voltage (kV)	:	.....

	i. Rated continous current at design ambient (50^0 C)	:	.....
	j. Rated Symmetrical interrupting current	:	.....
	k. One minute power frequency withstand voltage	:	.....
	l. Impulse withstand voltage (1.2/50 micro sec. Full wave)	:	.....
4.00.00	**INSULATORS**		
	a. Manufacturer	:	.....
	b. Type designation	:	.....
	c. Catalogue attached as Annexure No.	:	.....
5.00.00	**CURRENT TRANSFORMERS**		
	a. Manufacturer	:	.....
	b. Type designation	:	.....
	c. Catalogue attached as Annexure No.	:	.....
6.00.00	**VOLTAGE TRANSFORMERS**		
	a. Manufacturer	:	.....
	b. Type designation	:	.....
	c. Catalogue attached as Annexure No.	:	.....
7.00.00	**SWITCHES**		
	a. Manufacturer	:	.....
	b. Type designation	:	.....
	c. Catalogue attached as Annexure No.	:	.....
8.00.00	**INDICATING LAMPS**		
	a. Manufacturer	:	.....

b. Type designation : .....

c. Catalogue attached as Annexure No. : .....

9.00.00 **EARTHING TRUCK**

a. Manufacturer : .....

b. Type designation : .....

c. Catalogue attached as Annexure No. : .....

10.00.00 **SURGE ARRESTOR**

a. Manufacturer : .....

b. Type designation : .....

c. Rated voltage & frequency : .....

d. Nominal / rated discharge current : .....

e. Catalogue attached as Annexure No. : .....

11.00.00 **Complete single line diagram attached as Annexure No.** : .....

Protection, Control & Metering

1.00.00	**Numerical relays**		
1.01.00	General Technical Details and Drawings Enclosed	:	YES/NO
1.02.00	Make/Model No	:	……
1.03.00	Place of Manufacture	:	……
1.04.00	Hardware version number		
	a) Firmware version number	:	……
	b) Rated Voltage Vn (phase-to-neutral)	:	……
	c) Rated Current In	:	……
	d) Rated Frequency	:	……
	e) Over voltage capability - continuous	:	……
	f) Over voltage capability – 3s	:	……
	g) Burden on voltage transformers (VA per phase)	:	……
	h) Over current capability - continuous	:	……
	i) Over current capability – 1s	:	……
	j) Burden on current transformers (VA per phase)	:	……
	k) Reference standards	:	……
	l) Operating principle	:	……
	m) No Of communication Ports	:	……
1.05.00	Compliance to IEC-61850	:	YES/NO
1.06.00	Built-in functions provided in the relay (list out)		
	Protection Functions	:	……
	Measurements	:	……
	Monitoring Functions	:	……
	Control functions	:	……
1.07.00	Detailed Technical Catalogue for offered Relays enclosed	:	YES/NO

1.08.00	Spares and Repairs :	:	.....
1.09.00	State availability of spares in country and spares holding in country of origin	:	.....
1.11.00	Maximum repair turnaround time	:	.....
1.12.00	Define the proposed repair strategy	:	.....
1.13.00	Recommended spares list	:	.....
1.14.00	List of reference sites in operation for more than 1 year	:	.....
2.00.00	**DATA CONCENTRATORS**		
2.01.00	Hardware	:	.....
2.02.00	Operating System	:	.....
2.03.00	Clock Speed	:	.....
2.04.00	Memory (RAM)	:	.....
2.05.00	Hard disk Space For Storage	:	.....
2.06.00	Communication Protocols supported by the data concentrator for the Numerical Relay/IED integration and interfacing with higher level system	:	.....
2.07.00	Support for Back up	:	.....
2.08.00	Minimum Event/Alarm Storage	:	.....
2.09.00	Support for connecting HMI	:	.....
2.10.00	Support for connecting LAPTOP	:	.....
2.11.00	Serial RS 232 Ports Availability for future expandability	:	.....
2.12.00	TCP/IP Ports availability	:	.....
2.13.00	Support for connecting PRINTER	:	.....
2.14.00	Support for OPC Connectivity For Owners DDCMIS	:	.....
2.15.00	Support for RTU connectivity	:	.....
2.16.00	Support for Time Synchronization by GPS	:	.....

3.00.00	**Human-Machine Interface (HMI)**		
3.01.00	Bidder to confirm the compliance of HMI to specification requirements	:	YES/NO
3.02.00	Operating system for Operator's/Engineering Workstation	:	.....
3.03.00	**Workstations**		Operator's/Programmer's/Others
3.03.01	Make / Model No	:	.....
3.03.02	Processor	:	.....
3.03.03	Clock speed	:	.....
3.03.04	Hard disk size	:	.....
3.03.05	CD-ROM Drive & DVD Drive	:	.....
3.03.06	RAM	:	.....
	Please indicate each workstation includes the following :		
	a) CRT	:	YES/NO
	b) Function keyboard	:	YES/NO
	c) Mouse	:	YES/NO
3.03.07	CRTs		
	a) Make/Model No	:	.....
	b) Size of screen	:	.....
	c) SVGA monitor	:	YES/NO
	d) Suitable for table-top arrangement	:	YES/NO
3.03.08	Printers		
	a) Make/Model No	:	.....
	b) Speed of print (B&W)	:	.....
	c) Speed of print (color)	:	.....
3.04.00	**Laptop (Notebook) PC**		
	a) Make/Model No	:	.....

	b) Processor	:	.....
	c) Clock speed	:	.....
	d) Hard disk size	:	.....
	e) CD-ROM drive size	:	.....
	f) RAM	:	.....
4.00.00	**Communication Network**		
4.00.01	Data communication speed for LAN	:	.....
4.00.02	Interface with Owner's OPC-compliant DCS provided in line with the requirements of technical specification	:	YES/NO
5.00.00	**Ethernet switches**		
5.00.01	Compliance to IEC 61850	:	YES/NO
5.00.02	No of Ports	:	.....
5.00.03	Power supply to Ethernet Switches	:	.....
6.00.00	**Metering Network and Energy Meters (If applicable)**		
6.01.00	**Energy Meters**		
6.01.01	Manufacturer's type designation	:	.....
6.01.02	Accuracy (Power and Energy)	:	.....
6.01.03	Input Voltage	:	.....
6.01.04	Input current	:	.....
6.01.05	Mounting	:	.....
6.01.06	Communication (in Built 485 Port)	:	.....
6.01.07	Data recorded in Non-volatile memory	:	.....
6.01.08	Burden	:	.....
6.02.00	Type designation of RS 485 Converter	:	.....

6.03.00	Type designation of LAN cable	:	……
6.04.00	Type Designation of Data Cable	:	……

SUB-SECTION – DB9

DG SET

CLAUSE NO.	Bidder's Name ……..
	DATA REQUIREMENT FOR D.G. SETS
	Technical Information and data to be submitted with proposal.
1.00.00	**General**
1.01.00	.Bidder's name & address
1.01.02	Manufacturer's name & Type of equipment offered :
	a) Diesel engine along with accessories :
	b) Alternator :
	c) Exciter :
	d) Diesel generator control panel :
	e) Battery :
	f) Battery charger :
1.01.03	Overall dimension of set :
1.02.01	Net electrical output of DG set at : 50^0 C ambient (Not less than the rating specified,)
2.00.00	**Engine**
2.01.00	Rated BHP of engine at 38^0C :
2.02.00	Revolutions per minute :
2.03.00	Method of starting :
2.04.00	No of starting impulses :
2.05.00	Type of governor :
2.06.00	Guaranteed fuel oil consumption :
	a) At full load :
	b) At 3/4 load :

	c) At 1/2 load	:
3.00.00	**Storage Tank**	
3.01.00	Capacity	:
4.00.00	**Alternator**	
4.01.00	Rated KVA capacity at 40^0C	:
4.02.00	Rated KVA capacity at 50^0C	:
4.03.00	Degree of protection.	:
5.00.00	**Control panel**	
5.01.00	Overall Dimensions	:
6.00.00	Acoustic Details	:
6.01.00	Acoustic Enclosure	
	a) Sheet Material	:
	b) Sheet Thickness	:
7.00.00	**Drawings & Documents**	
7.01.00	Foundation plan showing location of foundation channel, floor plans etc.	
7.02.00	Supporting calculations for arriving at Diesel engine/alternator ratings at the specified ambient condition covering the following.	
	a) Rated BHP of engine at 38^0C as given by manufacturer.	
	b) Rated BHP of engine at 38^0C considering the deration factor as given by manufacturer	
	c) Rated BHP of engine at 50^0C after deduction of mechanical auxiliary loads connected on engine shaft.	
	d) Efficiency & Power factor of alternator at 100% load to calculate the output of DG set at site conditions.	

	e) Alternator rating at 40^0C as given by manufacturer
	f) Deration factors to be considered for site ambient conditions as given by the manufacturers.
	g) Alternator rating at 50^0C after considering the above deration factors.
	h) Electrical auxiliary load connected on alternator
7.03.00	Voltage drop calculation for starting the biggest motor of sizes as given under Technical parameters
7.04.00	Tentative layout of DG sets covering dimension of various equipments i.e. alternator, engine.

SUB-SECTION – DB10

OUTDOOR TRANSFORMERS

Technical Data Requirements For Post Award

PART - B

This volume contains Data sheets for Outdoor Transformers. All copies duly completed and preferably typed or written in indelible black ink to submitted during detailed engineering.

CLAUSE NO.	Technical Data Requirements (Post Award)	
1.00.00	**Transformer**	.....
1.01.00	Manufacturer's name and address	.....
1.01.01	Standard Applicable	.....
1.02.00	Rating (MVA)	.....
1.03.00	Voltage ratio	.....
. 1.04.00	Winding connection	.....
1.05.00	Vector group	.....
1.06.00	Number of phases	.....
1.07.00	Frequency (Hz)	.....
1.08.00	Type of cooling	.....
1.09.00	Impedance data	
	Guaranteed positive sequence impedance between HV & LV at 75 deg.C	
	i) Principal tap	.....
	ii) Maximum tap	.....
	iii) Minimum tap	.....
1.09.01	Zero Sequence Impedance	.....
1.10.0	Guaranteed max. losses in KW at 100 % rated voltage at 75 deg. C at principal tap	
	Iron loss at rated voltage & frequency	.....
	Copper loss at full load	.....
1.11.00	HV winding DC resistance at 75 deg. C	
	i) Principal tap	....
	ii) Maximum tap	....
	iii) Minimum tap	....
1.12.00	LV winding DC resistance	....

1.13.00	Cooling Equipment Details		
	a) Number of radiators and rating as % of transformer cooling equipment	.....	……
	b) Mounting	.....	……
	c) Cooler/radiator details		
	i) Overall dimensions l x b x h (mm)	.....	……
	ii) Type of mounting	.....	……
	iii) Weight with oil (kg)	.....	……
	iv) Weight without oil (kg)	.....	……
1.14.00	Thermal Data		
	a) Temperature rise in top oil over an ambient of 50 deg.C (deg.C)	.....	……
	b) Temperature rise in winding by resistance measurement method over an ambient of 50 deg.C .	.....	……..
	c) Thermal time constant (Hours)	.....	……
1.15.00	Withstand time for short circuit at terminals (sec.)	.....	……
1.16.00	Over excitation withstand time (secs.) for % over excitation of		
	i) 110%	.....	……
	ii) 125%	.....	……
	iii) 140%	.....	……
	iv) 150%	.....	……
	v) 170%	.....	……

1.17.00	Bushings		
	a) High voltage		
	i) Manufacturer	.....	.....
	ii) Type	.....	.....
	iii) Rated current (Amps)	.....	.....
	iv) Total creepage distance (mm)	.....	.....
	v) Mounting	.....	.....
	b) Low Voltage		
	i) Manufacturer	.....	.....
	ii) Type	.....	.....
	iii) Rated current (Amps)	.....	.....
	iv) Total creepage distance (mm)	.....	.....
	v) Mounting	.....	.....
	c) Neutral (LV)		
	i) Manufacturer	.....	.....
	ii) Type	.....	.....
	iii) Rated current (Amps)	.....	.....
	iv) Total Creepage distance (mm)	.....	.....
	v) Mounting	.....	.....
1.18.00	Proposed method of transformer transportation		
	(i). Oil filled or N2 filled	.....	.....
	(ii). Road Freight/ Rail Freight	.....	.....
1.19.00	Is vacuum filling required, if so state absolute pressure (mm of Hg)	.....	.....

1.20.00	Total quantity of oil (liters)	.....	……
1.21.00	Tap changing equipment		
	a) Make	.....	……
	b) Type & model	.....	……
	c) Voltage class & current	.....	……
	d) Number of steps	.....	……
	e) Range	.....	……
	f) Step voltage	.....	……
	l) Whether On load Type or Off load Type	……	
1.22.00	Insulation level		
	a) HV Windings		
	i) a) Lightning impulse withstand voltage (kV)	.....	……
	b) CW Impulse withstand voltage for HV	.....	……
	ii) Power frequency with-Stand voltage (kV rms.)	.....	……
	b) LV Winding		
	I) Lightning impulse withstand voltage (kVp)	.....	……
	ii) Power frequency with-stand voltage (kV rms)	.....	……
	c) HV Bushings		
	i) Lightning impulse Withstand voltage (kV)	.....	……
	ii) Power frequency with-stand voltage (kV rms)	.....	……
	d) LV Bushings		

	i) Lightning impulse withstand voltage (kV)	.....	.....
	ii) Power frequency with-stand voltage (kV rms)	.....	.....
	e) Neutral Bushings (LV)		
	i) Lightning impulse withstand voltage (kV)	.....	.....
	ii) Power frequency with-stand voltage (kV rms)	.....	.....
1.23.00	Approximate Dimensions		
	a) Tank (lxbxh) (mm)	.....	.....
	b) Overall dimensions with coolers (lxbxh) (mm)	.....	.....
	c) Height for un-tanking (mm)	.....	.....
	d) Shipping dimensions	.....	.....
	e) Dimensions of largest package(lxbxh) (mm)	.....	.....
1.24.00	Weights of Transformer Components		
	a) Core (kg.)	.....	.....
	b) Windings (kg.)(copper)	.....	.....
	c) Total cellulose weight (kg)	.....	
	d) Weight of Paper insulation (kg) .	.....	.....
	e) Weight of Press board, frame, barrier, spacer etc (kg)	.....	.....
	f) Tank and fittings (kg)	.....	.....
	g) Oil (kg)	.....	.....
	h) Untanking weight (heaviest piece) (kg)	.....	.....
	i) Total weight (kg)	.....	.....
	j) Weight of heaviest pkg. (kg)	.....	.....

	k) Total shipping weight (kg)	.....	……
	l) Parts detached for transport (furnish list)	.....	……
1.25.00	Permissible overloading (% of rating and time in minutes)	.....	……
1.26.00	Clearances		
	(a.) Minimum clearance of HV winding to tank in oil (mm)	……..	
	(b.) Minimum clearance of HV winding to earth in oil (mm)	.....	……
	(c.) Clearance between coils & core (mm)	.....	……
	(d.) Clearance between coils (mm)	.....	……
	(e.) Clearance between neutral to ground in air (mm)	.....	……
1.27.00	Conservator		
	a) Total volume (Liters)	.....	……
	b) Volume between highest and lowest levels (Liters)	.....	……
1.28.00	Capacitance Values (pF)		
	a) HV to earth	…….....	……
	b) LV to earth	.....	……
	c) HV to LV	.....	……
	d) Tap winding to earth	.....	……
1.29.00	a) Type of oil preservation	.....	……
	b) Material of diaphragm/air cell	.....	……
	c) Continuous temperature withstand/ capability of the diaphragm/air cell	.....	……

1.30.00	Oil		
	a) Quality of oil	Before filling in main tank	Before energisation
	i) Moisture content (ppm)	.....	…….
	ii) Max. tan-delta value (at 90 deg.C)	.....	……
	iii) Interfacial tension(N/m)	.....	……
	iv) Breakdown strength (kV)	.....	……
1.31.00	Core		
	a) Type of construction (core/shell)	.....	……
	b) Net core area (mm^2)	.....	……
	c) Core material and grade used	.....	……
	d) Type of joint between core and yoke	.....	……
	e) Thickness of stamping (mm)	.....	……
	f) Percentage silicon content (%)	.....	……
	g) Maximum flux density in core at rated frequency and at		
	i) 90% voltage (wb/m^2)	.....	……
	ii) 100% voltage (wb/m^2)	.....	……
	iii) 110% voltage (wb/m^2)	.....	……
1.32.00	Winding		
	a) Type of winding		
	i) HV	.....	
	ii) LV	.....	
	iii) Tap	.....	
	b) Current density at rated load		
	i) HV (A/mm^2)	.....	……

	ii) LV (A/mm^2) ....
	iii) Tap(A/mm^2) .....
	c) Conductor area
	i) HV (mm^2) ....
	ii) LV (mm^2) ....
	iii) Tap(mm^2) .....
	d) Magnetising inrush current (Amps) ....
	i) % Component of 2nd harmonic current (max & min) .....
	e) No load current (Amps) at rated frequency and at
	i) 90% voltage ....
	ii) 100% voltage ....
	iii) 110% voltage ....
	f) Magnetising current at rated frequency and at rated voltage ....
	g) Leakage reactance
	i) HV (ohms) ....
	ii) LV (ohms) ....
	h) Resistance
	i) HV (ohms) ....
	ii) LV (ohms) ....
1.33.00	Tank
	a) Tank cover-Conventional/Bell Type ....
	b) Approximate thickness of
	i) Side (mm) ....
	ii) Bottom (mm) ....
	iii) Cover ....
1.34.00	Vacuum withstand capability of
	a) Main tank ....

	b) Coolers and accessories	..... ……
1.35.00	Minimum draw bar pull required to move the transformer on level track (kg)	..... ……
1.36.00	Size of filter hose	..... ……
1.37.00	Fault level	..... ……
1.38.00	**NGR**	**3.3 KV/11 KV**
1.39.00	i) Name of Manufacturer	……..……
	ii) Type	……..……..
	iii) Resistance material	……..……
	iv) Voltage	……..……
	v) Rated Current	……..……
	vi) Rated Duty	……..……
	vii) Total Resistance of resistor	……..……..
	viii) Max. allowable temp. rise	……..……..
.	ix) Service	……..……..
	x) Degree of protection	……..……..
	xi) Weight of complete NGR	……..……
	xii) Reference Standard	……..……
	xiii) Enclosure material & Thickness	……..……
	xiv) Max. overall dimensions	……..……
	xv) Test Voltage (withstand value)	……..……

SUB-SECTION – DB11

LIGHTING

CLAUSE NO.	Bidder's Name ……..

LIGHTING SYSTEM

1.00.00	**Lighting Panel**			
	a)	Make	.....	.....
	b)	Applicable standard	.....	.....
	c)	Enclosure	.....	.....
	d)	Degree of protection	.....	.....
		i) Indoor	.....	.....
		ii) Outdoor	.....	.....
2.00.00	**Miniature circuit Breaker**			
	a)	Make	.....	.....
	b)	Type designation	.....	.....
	c)	Applicable standard	.....	.....
	d)	Rated current/ voltage	.....	.....
	e)	Breaking capacity at 0.6 p.f.	.....	.....
	f)	Catalogue attached as annexure no.	.....	.....
3.00.00	**Lighting fixtures & Accessories**			
	a)	Make of lighting fixture & accessories	.....	.....
	b)	Catalogue for each type of fixture attached as annexure no	.....	.....
	c)	Applicable Standard	.....	.....
4.00.00	**Receptacles/Sockets**			
	a)	Make	.....	.....
	b)	Type	.....	.....

	c)	Applicable standard	....
5.00.00	**Junction Boxes**		
	a)	Make	....
	b)	Type	....
	c)	Material	....
	d)	Applicable standard	....
6.00.00	**Rigid steel Conduits/Fittings**		
	& Accessories		
	a)	Make	....
	b)	Material	....
	c)	Applicable standard	....
7.00.00	**Flexible steel standard**		
	a)	Make	....
	b)	Applicable standard	....
8.00.00	**Lighting poles**		....
	a)	Make	....
	b)	Applicable standard	....
	c)	Type	....
	d)	Pole height	....
9.00.00	**Lighting masts**		
	a)	Make	....
	b)	Type	....
	c)	Overall height	....
	d)	Applicable standard	....

	e)	Catalogue attached as annexure no.	....
10.00.00	**Emergency Lighting Transformers**		
	a)	Make	....
	b)	Voltage Ratio	....
	c)	KVA Rating	....
11.00.00	**LED Lighting**		
	a)	Make of LED	……
	b)	LED Rating	……
		(Current, Voltage, Power)	
	c)	Lumen Efficacy (lm/Watt)	……
	d)	Driver Type & Rating	……
	e)	Colour Rendering Index (CRI)	……

SUB-SECTION – DB12

FIRE PROOF SEALING SYSTEM

CLAUSE NO.	Bidder's Name ……..

FIRE -PROOF SEALING SYSTEM

1.0 **Type 'A'**

i) Type of System .....

ii) Maker's name & Country of manufacture .....

iii) Catalogue of System .....

2.0 **Type 'B'**

i) Type of System .....

ii) Maker's name & Country of manufacture .....

iii) Catalogue of System .....

CHAPTER - III

TECHNICAL INFORMATION

AND

DATA TO BE SUBMITTED

AFTER AWARD OF CONTRACT

CLAUSE NO.	BIDDER'S NAME
	TECHNICAL INFORMATION / DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT
1.00.00	**GENERAL** The various drawings and data sheets to be furnished shall include the following
1.01.00	Final versions of all drawings and data sheets enclosed with the proposal shall be confirmed. Revision of any data furnished earlier must meet the approval of Owner.
2.00.00	Contractor shall furnish the following Data/Drawings/information after award of contract.
2.01.00	List of sub-suppliers/Sub-vendors/Sub/contractor with details and particulars as called for else where.
2.02.00	Bill of material with respect to each piping drawing and consolidated Bill of material.
2.03.00	Marked up prints of all layout drawings of OWNER/ ENGINEER / CONTRACTOR's indicating all modifications carried out at site.
2.04.00	Outline and cross sectional drawings of all equipments indicating overall dimensions, erection and maintenance space requirement, weights, construction features, materials of construction, details of test to be carried out, foundation details if any.
2.05.00	Motor operator details
2.06.00	Wring diagram
2.07.00	Material Test Certificates
2.08.00	Catalogue/Technical literature on all the products, supplies by Contractor.
2.09.00	Shop and field test reports.
2.10.00	Details of paints and painting material
2.11.00	Material test certificates for all supply items.
2.12.00	Bar charts and progress report (periodically and regularly up-dated).
2.13.00	Detailed calculations of all foundation designs/supports design included in Contractor's Scope.
3.00.00	**Performance Data-Sizing calculations/Data Sheets/Performance Curves/P&IDs** Contractor shall submit/furnish all relevant drawings/documents required to conform design requirements as elaborated in technical specifications. Some of the drawings/documents required are listed below, however, the list is not exhaustive. Contractor to submit all the related drawings/documents which shall be necessary to substantiate design requirements and other requirements to ensure compliance to specification requirements:

(i) SIZING

- FGD System Design Basis
- Selection of Material and Application Procedure
- Duct Sizing Calculation
- Absorber Design Basis and Sizing Calculation
- Predicted Performance of FGD System at
- a. Design point
- b. Guarantee point
- c. Other specified loads
- Absorber Performance Curves
- Waste water sizing
- Selection parameter for Slurry Recirculation Pumps
- Selection parameter for Oxidation Air Blower
- Sizing Calculation for Emergency Quenching System
- Selection parameter for Gypsum Dewatering System
- Selection parameter for Limestone slurry pumps
- Sizing Calculation for Limestone slurry storage tank
- Selection parameter for Pulverizer
- Sizing Calculation for Pulverizer hydrocyclone / circuit pump
- Sizing Calculation for Primary Dewaterng Hydorcyclone / Tank
- Selection parameter for Vacuum Belt filters
- Selection parameter for Vacuum Pumps
- Sizing Calculation for Filtrate Water Tank
- Selection parameter for Filtrate Water Pumps

- Sizing Calculation for Waste Water System

  a. Secondary Hydro-cyclone Feed Tank and Pump

  b. Secondary Hydrocyclone

  c. Waste Water Tank

  d. Lime Feed Tank

  e. Selection parameter for Waste Water Pump
- Sizing Calculation for Process Water Tank
- Selection parameter for Process Water Pump
- Selection parameter for Mist Eliminator Wash Water Pump
- Sizing Calculation for Auxiliary Absorbent Tank
- Selection parameter for Auxiliary Absorbent Pump
- Limestone crusher sizing
- Limestone & Gypsum conveyor sizing
- Limestone & Gypsum silo sizing
- Mass Balance diagram at GP & DP along with supporting calculations
- Other sizing documents to be finalised before award

(ii) Datasheets / Performance Curves for

- Absorber
- Mist Eliminator
- Spray Nozzles
- Oxidation nozzles / lances
- Slurry Recirculation Pumps
- Oxidation Air Blower

- Emergency Quenching System
- Gypsum Dewatering Pump
- Limestone slurry pumps
- Limestone slurry storage
- Pulverizer
- Pulverizer hydrocyclone / circuit pump
- Primary Dewaterng Hydorcyclone / Tank
- Vacuum Belt filters
- Vacuum Tank / Pumps
- Filtrate Water Tank
- Filtrate Water Pumps
- Waste Water System
  a. Secondary Hydro-cyclone Feed Tank / Pump
  b. Secondary Hydrocyclone
  c. Waste Water Tank / Pump
  d. Lime Feed Tank
- Process Water Tank / Pumps
- Mist Eliminator Wash Water Pump
- Auxiliary Absorbent Tank
- Auxiliary Absorbent Pump
- Agitators (Absorber / Limestone slurry Storage Tank / Sumps / Auxiliary Absorbent Tank / Mill Tank)
- Sump Pumps
- Miscellaneous Pumps

- Valves
- Gates
- Expansion Joints
- Insulation
- Elevator
- Limestone Crusher

(iii) P&IDs

- P&ID of Flue Gas System
- P&ID of GGH - Gas System
- P&ID of Absorber
- P&ID of Oxidation System
- P&ID of Emergency Quench system
- P&ID of Mist Eliminator Wash Water System
- P&ID of Limestone Storage and Feed system
- P&ID of Limestone Pulverizer
- P&ID of Limestone Pulverizer Drive / Lube Oil system
- P&ID of Gypsum dewatering System - Primary
- P&ID of Gypsum dewatering System - Secondary
- P&ID of Vacuum System
- P&ID of Filtrate Water System
- P&ID of Waste Water System
- P&ID of Process Water System
- P&ID of Auxiliary Absorbent System

- P&ID of Sump System
  (Absorber, Grinding and Dewatering Areas)

4.00.00 **PERFORMANCE DATA**

i) Model testing procedure.

ii) Schedule of instrumentation and control equipment.

iii) Characteristic curves for the motors showing.

a) Torque-speed
b) Current speed

c) Current time

d) Locked motor withstand curves (hot and cold)

e) Thermal withstand curves (hot and cold)

iv) Description of the method to be adopted for protection of the equipment during manufacturer, shipment and storage at site.

v) Shipping breakdown of all equipments

vi) Technical documents clearly bringing out the features of design and construction of the component parts of all equipments furnished.

vii) Instruction for erection, testing, commissioning, Operation and maintenance of all equipments.

viii) A complete list of auxiliary equipment and accessories furnished.

ix) Calculation for thermal insulation thickness and thickness adopted for various parts of the equipment/works

x) Details of specifications of insulating materials including cladding sheet & finishing method.

xi) Location, loading and arrangement of control room building in plan and sections.

xii) List of lubricants, their specifications and the respective quantities covered under the specification.

xiii) Final schedule of all local instruments and primary sensing devices furnished as part of this package with values (normal and maximum) of the associated parameters, locations, manufacturer, type, range, accuracy, dial size, connection details and contact details such as ratings, number and configuration.

xvi) List of signaling contacts/impulses for the systems furnished, together with the cable schedules, wiring diagrams, interconnection diagrams and the cable specifications. GA drawing, mounting and cut-out details for panels, consoles, etc.

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	xv) Final list of insert panels, control cabinets and local control panels furnished together with the cable specifications. GA drawing, mounting and cut-out details for panels, consoles etc. xvi) Details of A.C. feeders and corresponding power requirements indicating number and capacity of feeder at available voltage. xvii) Compressed air (station and instrument) requirements stating the parameters such as pressure, quality and quantity for the various equipments. xviii) Cooling water requirements equipment - wise, stating the parameters such as pressure, quality and flow rate. xix) Recommended list of digital and analogue inputs to the data logger computer. xx) List of final particulars of power, prefabricated and special cables included in the proposal.