



**Bangalore Development Authority
T. Chowdaiah Road, Kumara Park West
Bangalore – 560 020**

TENDER FOR THE WORK

Of

“Development of Major Arterial Road, Phase -1 in Nada Prabhu Kempegowda Layout”

(Through GOK e – Procurement Platform <https://eproc.karnataka.gov.in>)

VOLUME II

SECTION 7C: TECHNICAL SCHEDULES, PART 2

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TECHNICAL SCHEDULES

PREAMBLE TO OTHER SCHEDULES

1. Tenderers are required to provide full and complete information as detailed in the Schedules. All Schedules are required to be completed, but Tenderers should not necessarily restrict themselves to using the space that is provided; Tenderers will be responsible for providing additional sheets/pages and/or supplementary information wherever necessary to fully communicate the required information. The information will be examined to assess the capability of the tenderer to carry out the work in accordance with the requirements of the Contract.
2. In the event that any particular Schedule or item in the Schedule is not applicable, the Tenderer shall clearly indicate the same and provide full and complete justification regarding why it is not applicable.
3. The Employer wishes to clarify that regardless of what is proposed by the Tenderer, the successful Tenderer shall be required to conform in all respects to the requirements of the Contract, and all proposals shall be subject to the approval of the Engineer. Acceptance of the Tenderer's proposal for the purposes of tender evaluation shall not be construed as approval by the Employer. All details will subsequently be subject to the approval of the Engineer during execution of the Contract. No claim for additional payments shall be entertained, other than in accordance with the Contract.

The Tenderer shall note that, Tenderer is required to affix Tenderer's seal and authorized signature on all pages of Schedules.

7 C 1. SUB-SECTION

TECHNICAL SCHEDULE I

CONSTRUCTION PROGRAMME

TECHNICAL SCHEDULE I

CONSTRUCTION PROGRAMME (To be completed by the Tenderer)

Name of the Tenderer

The Tenderer shall submit a realistic construction programme which he proposes to adopt for executing the Works. This shall be in sufficient detail so as to show the order and duration of key activities required to carry out the Works (including each stage of mobilization of labour, setting up of site offices/ workshops/ consents and approvals, procurement, manufacture, pre-delivery inspection and testing, delivery to Site, construction, erection, testing, commissioning and operation and maintenance).

The Tenderer should pay particular attention to ensuring that the proposed programme is integrated with the Method Statement.

The construction programme shall be developed and presented on a commercially available project management software (such as Primavera, MS Project or equivalent), together with bar charts and CPM and PERT diagrams which clearly illustrate the critical path to achieve the desired results.

7 C 2. SUB-SECTION

TECHNICAL SCHEDULE II PROPOSED PLANT DETAILS

TECHNICAL SCHEDULE II
PROPOSED PLANT DETAILS
(To be completed by the Tenderer)

2.1 Mechanical Works

2.1.1 Submersible Pump Set

S. No.	Description		Units	Particulars		
				Plant Water	Plant Drain	Thickener feed
(a)	(i)	Tank capacity	cum			
	(ii)	Tank Dimensions	mm			
(b)	Pump					
	(i)	Pump Make				
	(ii)	Type				
	(iii)	Model				
	(iv)	Quantity (W+S)	Nos.			
	(v)	Capacity	m ³ /s			
	(vi)	Head	mlc			
	(vii)	Shut off Head	metres			
	(viii)	NPSH required	metres			
	(ix)	Submergence required	metres			
	(x)	Efficiency	%			
	(xi)	Absorbed power at duty point	kW			
	(xii)	Motor rating	kW			
	(xiii)	Speed	rpm			
(c)	Material of construction:					
	(i)	Casing				
	(ii)	Impeller				
	(iii)	Shaft				
	(iv)	Mechanical Seal				
	(v)	Lifting Chain and Guide Bar				
	(vi)	Cooling Jacket				
	(vii)	Discharge size	mm			
	(viii)	Suction size	mm			
	(ix)	Flange Drilling standard:				
	(x)	Weight (Pump + Motor)	kgs			
(d)	Testing & Inspection:					
	(i)	Pump performance testing standard				

S. No.	Description		Units	Particulars		
				Plant Water	Plant Drain	Thickener feed
	(ii)	Maximum Noise level	dB(A)			
	(iii)	Maximum velocity of vibration	mm/sec			
(e)	Motor :					
	(i)	Make				
	(ii)	Type				
	(iii)	Model				
	(iv)	Quantity (W+S)				
	(v)	Rating	kW			
	(vi)	Weight	kgs			

2.1.2 Scum Pumpset

S. No.	Description		Units	Particulars	
				Primary	Secondary
(a)	General				
	(i)	Make			
	(ii)	Model			
	(iii)	Type			
	(iv)	Quantity (W+S)	No.s		
(b)	Performance				
	(i)	Capacity	cu.m/hr		
	(ii)	Total head	mlc		
	(iii)	Speed	rpm		
	(iv)	Overall efficiency (Pump + Motor)	%		
	(v)	Motor Rating	kW		
(c)	Materials of Construction				
	(i)	Casing			
	(ii)	Impeller			
	(iii)	Shaft			
	(iv)	Mechanical Seal			
	(v)	Lifting Chain and Guide Bar			
	(vi)	Delivery pipe and diameter			

S. No.	Description	Units	Particulars	
			Primary	Secondary
	(vii) Cooling Jacket			
(d)	Weight	Kgs		
(e)	Testing & Inspection:			
	(i) Pump performance testing standard			
	(ii) Maximum Noise level	dB(A)		
	(iii) Maximum velocity of vibration	mm/sec		

2.1.3 High Speed Turbo Air Blowers

S. No.	Description	Units	Particulars
(a)	General		
	(i) Make		
	(ii) Type		
	(iii) Quantity (W+S)	Nos.	
	(iv) Capacity at NTP	m ³ /min	
	(v) Design maximum discharge pressure	mlc	
	(vi) Efficiency	%	
	(vii) Speed, blower	rpm	
	(viii) Absorbed power	kW	
	(ix) Motor rating	kW	
	(x) Speed, motor	rpm	
	(xi) Noise level at Duty Point in dB(A) at 1.86 m from the unit	dB(A)	
	(xii) Vibration	mm/sec	
	(xiii) With Acoustic Hood	dB(A)	
	(xiv) Without Acoustic Hood	dB(A)	
	(xv) Weight – Blower	kgs	
	(xvi) Maximum lifting weight	kgs	
	(xvii) Dimensions (L x W x H)	m x m x m	
	(xviii) Coupling Type		
	(xix) Coupling Make		
	(xx) Cooling System		
(b)	Material of construction:		
	(i) Casing		
	(ii) Impeller		
	(iii) Shaft		
	(iv) Common Base frame		

S. No.	Description	Units	Particulars
	(v) Orientation		
(c)	Acoustic Hood:		
	(i) Type		
	(ii) Material of Construction		
(d)	Inlet/Outlet silencer		
	(i) Type		
	(ii) Make		
	(iii) Filter media		
	(iv) Mean air velocity	m/s	
(e)	Noise reduction (mean) Air release valves		
	(i) Number	Nos.	
	(ii) Diameter	mm	
	(iii) Type		
	(iv) Set pressure	bar	
	(v) Make		
(f)	Delivery non-return valves		
	(i) Number	Nos.	
	(ii) Diameter	mm	
	(iii) Type		
	(iv) Make		
(g)	Delivery isolation valves		
	(i) Number	Nos.	
	(ii) Diameter	mm	
	(iii) Type		
	(iv) Make		

2.1.4 Permanent Magnet Motor for Air Blowers

Sr. No.	Description	Unit	Particulars
(a)	Make		
(b)	Type Designation		
(c)	Rating	kW	
(d)	Particulars at rated voltage and frequency :		
(i)	Starting time	Sec.	
(ii)	Starting current	% FL	
(iii)	Pull-out torque	% FLT	
(iv)	Pull-up torque	% FLT	

Sr. No.	Description	Unit	Particulars
(e)	Minimum voltage required under starting conditions to accelerate driven equipment to rated speed.	Volts	
(f)	Starting time at specified minimum starting voltage	Sec.	
(g)	Permissible running time at full load at minimum allowable voltage	Min.	
(h)	Locked rotor current withstand time (safe stall time) at 110% rated voltage		
(i)	At rated temp. (Hot)	Sec.	
(ii)	When cold	Sec.	
(i)	Stator thermal time constant	Sec.	
(j)			
(i)	Permissible no. of equally spread starts per hour under normal service conditions	No.	
(ii)	Permissible no. of starts in quick succession with cold machine at room temperature	No.	
(iii)	Permissible no. of hot restarts	No.	
(iv)	Starts per 8 hour period and 24 hour period	No.	
(k)	Space Heaters :		
(i)	Rated voltage, no. and location	Volts	
(ii)	Rating (Total)	KW	
(l)	Terminal box:		
(i)	Fault withstand capacity at rated voltage and duration	MVA for Secs.	
(m)	Insulation treatment		
(n)	Embedded temperature detectors		
(i)	Make & Type		
(ii)	Number		
(iii)	Resistance at 0° C	Ohm	

Sr. No.	Description	Unit	Particulars
(o)	Efficiency		
(i)	Full Load		
(ii)	$\frac{3}{4}$ Load		
(iii)	$\frac{1}{2}$ Load		
(iv)	At duty point		
(p)	Power factor		
(i)	Full Load		
(ii)	$\frac{3}{4}$ Load		
(iii)	$\frac{1}{2}$ load		
(q)	Total guaranteed losses comprising iron loss, copper loss, friction, windage and stray losses	kW	
(i)	Break up : Iron loss	kW	
(ii)	Copper loss	kW	
(iii)	Friction, windage and stray losses	kW	
(r)	Motor bearings		
(i)	Permissible temperature rise for bearings	$^{\circ}$ C	
(ii)	Design ambient temperature assumed for above	$^{\circ}$ C	
(s)	Motor bearing lubrication system self lubrication / forced oil lubrication		
(t)	Stator core temperature detectors		
(i)	Type and Make		
(ii)	Number		
(iii)	Resistance at 0° C	Ohm	
(u)	Permissible vibration limits	mm/sec	
(v)	Wr^2 Value	kg-m ²	
(w)	Weight	Kg	

2.1.5 Manual Hoists

Sr. No.	Description	Particulars							
		Pri. Sludge PS	Pri. Scum pit	Sec. Scum Pit	Thickened Sludge PS	Digester Sludge mixing PS	Centrifuge feed PS	Plant water Ps	Plant Drain Ps
(a)	Capacity (tonnes)								
(b)	Quantity								
(c)	Class								
(d)	Lift (m)								
(e)	Span (m)								
(f)	Length of the runway (m)								
(g)	Hook type / Construction								
	- I.S. Specification No.								
	- Swivel type								
(h)	Wire rope construction and standard								
(i)	Specification/ Type of Rails for Long Travel								
(j)	Painting								
	- Type of primer coat								
	- No. of coats of paint								

2.1.6 Submersible Pump Set

S. No.	Description		Units	Particulars		
				Plant Water	Plant Drain	Thickener feed
(a)	(i)	Tank capacity	cum			
	(ii)	Tank Dimensions	mm			

S. No.	Description		Units	Particulars		
				Plant Water	Plant Drain	Thickener feed
(b)	Pump					
	(i)	Pump Make				
	(ii)	Type				
	(iii)	Model				
	(iv)	Quantity (W+S)	Nos.			
	(v)	Capacity	m ³ /s			
	(vi)	Head	mlc			
	(vii)	Shut off Head	metres			
	(viii)	NPSH required	metres			
	(ix)	Submergence required	metres			
	(x)	Efficiency	%			
	(xi)	Absorbed power at duty point	kW			
	(xii)	Motor rating	kW			
	(xiii)	Speed	rpm			
(c)	Material of construction:					
	(i)	Casing				
	(ii)	Impeller				
	(iii)	Shaft				
	(iv)	Mechanical Seal				
	(v)	Lifting Chain and Guide Bar				
	(vi)	Cooling Jacket				
	(vii)	Discharge size	mm			
	(viii)	Suction size	mm			
	(ix)	Flange Drilling standard:				
	(x)	Weight (Pump + Motor)	kgs			
(d)	Testing & Inspection:					
	(i)	Pump performance testing standard				
	(ii)	Maximum Noise level	dB(A)			
	(iii)	Maximum velocity of vibration	mm/sec			
(e)	Motor :					
	(i)	Make				
	(ii)	Type				
	(iii)	Model				
	(iv)	Quantity (W+S)				
	(v)	Rating	kW			
	(vi)	Weight	kgs			

2.1.7 Gates ⁺

S. No.	Description	Units	Particulars
(a)	(i) Make		
	(ii) Model		
	(iii) Quantity (W+S)		
	(iv) Service		
	(v) Type		
	(vi) Spindle Type		
	(vii) Size	mm x mm	
	(viii) Weight	kgs	
	(ix) Seating Head	m	
	(x) Unseating Head	m	
(b)	Material of construction:		
	(i) Wall Thimble		
	(ii) Gate		
	(iii) Frame		
	(iv) Spindle		
	(v) Stem coupling		
	(vi) Seating face		
	(vii) Wedge		
	(viii) Headstock		
	(ix) Gear House cover & stem guide		
	(x) Lift Nut		
	(xi) Fasteners & Anchors		
	(xii) Lifting mechanism, Gear House & stem guide		
(c)	Gate Actuators +		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		
	(v) Number	Nos	
	(vi) Motor Rating	kw	
	(vii) Motor speed	rpm	
	(viii) Protection		
	(ix) Gear Reducer Make		
	(x) Type		

+Bidder to provide above details for each size of Gate and Service including modulating type of gates

2.1.8 Valves

S. No.	Description	Units	Particulars
(a)	<u>Butterfly valves .#</u>		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		
	(v) Quantity (W+S)	Nos.	
	(vi) Size	mm	
	(vii) Rating	PN	
	(viii) Test pressure	bar	
	Material of construction		
	(ix) Body		
	(x) Disc		
	(xi) Sealing face		
	(xii) Shaft		
	Gear Reducers		
	(i) Make		
	(ii) Material		
	(iii) Flange Drilling standard		
(b)	Butterfly Valve Actuators #		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		
	(v) Quantity (W+S)	Nos.	
	(vi) Motor rating	kW	
	(vii) Design Torque	N-m	
	(viii) Time for full open to full close	seconds	
(c)	Plug valve		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		
	(v) Quantity (W+S)	Nos.	
	(vi) Size	mm	
	(vii) Rating	PN	
	(viii) Test pressure	bar	
	(ix) Body material		
(d)	Non-return valves #		
	(i) Make		
	(ii) Type		
	(iii) Model		

S. No.	Description	Units	Particulars
	(iv) Service		
	(v) Quantity (W+S)	Nos.	
	(vi) Size	mm	
	(vii) Rating	PN	
	(viii) Test Pressure	bar	
	(ix) Design standard		
	(x) Flange drilling standard		
(e)	Material of construction:		
	(i) Body		
	(ii) Disc/plates		
	(iii) Spring		
	(iv) Shaft		
(f)	Sluice valves :#		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		
	(v) Number	Nos	
	(vi) Size	mm	
	(vii) Rating	PN	
	(viii) Test pressure	bar	
	Material of construction		
	(ix) Body		
	(x) Gate		
	(xi) Sealing face		
	(xii) Shaft		
	Gear Reducers		
	(i) Make		
	(ii) Material		
	(iii) Flange Drilling standard		
(g)	Sluice Valve Actuators #		
	(i) Make		
	(ii) Type		
	(iii) Number		
	(iv) Motor rating	kW	
	(v) Design Torque	N-m	
	(vi) Time for full open to full close	seconds	
(h)	<u>Knife Gate valves :#</u>		
	(i) Make		
	(ii) Type		
	(iii) Model		
	(iv) Service		

S. No.	Description	Units	Particulars
	(v) Number		
	(vi) Size	mm	
	(vii) Rating	PN	
	(viii) Test pressure	bar	
	(ix) Body material		
	(x) gate material		
	(xi) Sealing face material		
	(xii) Shaft material		
	(xiv) Gear Reducers :		
	(xv) Make		
	(xvi) Material		
	(xvii) Flange Drilling standard		
(i)	Knife Gate Valve Actuators [#]		
	(i) Make		
	(ii) Type		
	(iii) Number		
	(iv) Motor rating	kW	
	(v) Design Torque	kg-m	
	(vi) Time for full open to full close	seconds	
(j)	Telescopic valve		
	(i) Make		
	(ii) Quantity (W+S)	Nos.	
	(iii) Type		
	(iv) Pressure rating	PN	
	(v) Diameter /size	m	
	(vi) End connection		
	(vii) Material of construction:		
	(viii) Valve Body		
	(ix) Spindle		
	(x) Disc/gate		
	(xi) Lining		
	(xii) Fasteners		

Bidder to provide above details for each size, type of Valve and Service

2.1.9 Air-conditioning Equipment (For SCADA Room)

S. No.	Description	Units	Particulars
(a)	(i) Make		
	(ii) Model		
	(iii) Type		
	(iv) Capacity	TR	

S. No.	Description	Units	Particulars
	(v) Quantity	Nos.	
	(vi) Motor Rating	kW	
	(vii) Air-Ducting :		
	(viii) Material		
	(ix) Size		
	(x) Quantity		
	(xi) Whether all the required accessories are provided	Yes/No	

2.1.10 Butterfly Valves

Sr. No.	Item	Unit	Description		
			Filter Water Outlet	Backwash water Inlet	Backwash Air Inlet
(a)	General				
	(i)	Manufacturer			
	(ii)	Type			
	(iii)	Model			
	(iv)	Service			
	(v)	Quantity			
	(vi)	Size	mm		
	(vii)	Rating	bar		
	(viii)	Test pressure	bar		
	(ix)	Body material			
	(x)	Disc material			
	(xi)	Sealing face material			
	(xii)	Shaft material			
	(xiii)	Gear Reducers :			
	(xiv)	Manufacturer			
	(xv)	Material			
	(xvi)	Flange Drilling standard			
(b)	Valve Actuators				
	(i)	Manufacturer			
	(ii)	Type			
	(iii)	Model			
	(iv)	Service			
	(v)	Quantity			
	(vi)	Motor rating	kW		
	(vii)	Design Torque	Kg-m		
	(viii)	Time for full open to full close	minutes		

2.1.11 Sluice valves

Sr. No.	Item		Unit	Description	
				Backwash Overhead Tank control	Drain valve of each filter
(a)	(i)	Manufacturer			
	(ii)	Type			
	(iii)	Model			
	(iv)	Service			
	(v)	Number	Nos.		
	(vi)	Size	mm		
	(vii)	Rating	bar		
	(viii)	Test pressure	bar		
	(ix)	Body material			
	(x)	gate material			
	(xi)	Sealing face material			
	(xii)	Shaft material			
	(xiii)	Gear Reducers			
	(xiv)	Manufacturer			
	(xv)	Material			
	(xvi)	Flange Drilling standard			
(b)		Sluice Valve Actuators			
	(i)	Manufacturer			
	(ii)	Type			
	(iii)	Number	Nos.		
	(iv)	Motor rating	kW		
	(v)	Design Torque	Kg-m		
	(vi)	Time for full open to full close	minutes		

2.1.12 Propeller Exhaust Fan

S. No	Description		Units	Particulars SPS
(a)	Fan			
	(i)	Make		
	(ii)	Make		
	(iii)	Model		
	(iv)	Impeller diameter	mm	
	(v)	Impeller speed	rpm	

S. No	Description	Units	Particulars SPS
	(vi) Capacity	cum/hr	
	(vii) Static pressure	mmlc	
	(viii) Shaft power	W	
	(ix) Fan total efficiency	%	
(b)	Motor		
	(i) Make		
	(ii) Rating	kW	
(c)	Overall weight	kg	

2.1.13 Service Water Pumps

S. No.	Description	Units	Particulars
(a)	(i) Make		
	(ii) Type		
	(iii) Service/Location		
	(iv) Quantity (W+S)	Nos.	
	(v) Capacity	cum/hr	
	(vi) Head	mhc	
	(vii) Efficiency	%	
	(viii) Power absorbed	kW	
	(ix) Speed	rpm	
	(x) Motor rating	kW	

Note: All Equipment shall be of reputed make and shall qualify the criteria clause no 8.40 of part 8 of this Bid document.

7 C 3. SUB-SECTION

TECHNICAL SCHEDULE III

INSTRUMENTATION & CONTROL EQUIPMENT

TECHNICAL SCHEDULE III

INSTRUMENTATION & CONTROL EQUIPMENT

(To be completed by the Tenderer)

3.1 Instrumentation, Control & Automation Equipments

S. No	Description	Unit	Particulars
3.1.1	Flow Measuring System		
(a)	Electro Magnetic Flow Meter (i) Make and Model (ii) Accuracy (iii) Principle of measurement (iv) Measuring Range		
3.1.2	Turbo Blower system Instruments		
(a)	Air Flow Measurement System (i) Make and Model (ii) Measuring Range (iii) Accuracy (iv) Principle of measurement		
(b)	Air Pressure Measurement System (i) Make and Model (ii) Measuring Range (iii) Accuracy (iv) Principle of measurement		
(c)	Air Temperature Measurement System (i) Make and Model (ii) Measuring Range (iii) Accuracy (iv) Principle of measurement		

S. No	Description	Unit	Particulars
3.1.3	Level Measuring System		
(a)	Ultrasonic Type (i) Make and Model (ii) Beam Angle (iii) Accuracy		
(b)	Capacitance Type (i) Make and Model (ii) Accuracy		
(c)	Level Switches (i) Make and Model (ii) Type (iii) Range (iv) Accuracy		
3.1.4	Pressure Indicating Transmitter		
	(i) Make and Model (ii) Type (iii) Range (iv) Accuracy (v) Re-Transmission output		
3.1.5	Pressure Gauges		
	(i) Make and Model (ii) Type (iii) Accuracy		
3.1.6	Pressure Switches		
	(i) Make and Model (ii) Type (iii) Accuracy		

S. No	Description	Unit	Particulars
3.1.7	Instrumentation Copper Earthing (i) Make and Model (ii) Type of Material		
3.1.8	Temperature-Measuring System (i) Make and Model (ii) Range (iii) Type (iv) Accuracy (v) Principle of Measurement		
3.1.9	Temperature Scanner Indicator (i) Make and Model (ii) Accuracy (iii) No. of Channels (iv) Number of alarm contacts per channel		
3.1.10	Alarm Annunciators (i) Make and Model (ii) No. of Windows (iii) Accuracy		
3.1.11	Two & Three Position Selector Switches (Including Electrical Accessories Like :- P.B's , LED's, MCB's e.t.c) (i) Make and Model		
3.1.12	Panel Mounted Digital Indicators (i) Make (ii) Model No (iii) Accuracy		
3.1.13	Surge Protection Devices		

S. No	Description	Unit	Particulars
	(i) Surge Rating (ii) Make & Model		
3.1.14	Junction Boxes & Field Enclosures (i) Make (ii) Model		
3.1.15	Weight Indicator cum Transmitter (i) Make and Model (ii) Type (iii) Accuracy		
3.1.23	Programmable Logic Controller (Redundant Hot Standby) & PLC Programming software		
(a)	Make , Model & Series		
(b)	Number of Inputs(CPU , I/O & Communication Modules, Converters, Switches shall be of the same series) (i) Digital Inputs (ii) Model No		
	(iii) Digital output (iv) Model No		
	(v) Analog Inputs (vi) Model No		
	(vii) Analog outputs (viii) Model No		
(c)	Memory		
	Redundant Power Supply Modules for PLC CPU (i) Make		

S. No	Description	Unit	Particulars
	(ii) Model No		
(d)	CPU, Communication Modules, Industrial Ethernet Switches		
	(i) Make		
(e)	(ii) Model No		
	Portable Programming Unit (Laptop)		
(f)	Redundant RTU+ GSM/GPRS Communication modules along with Interface Panel for communication with MIS-2, SCADA center		
	(i) Type, Make & Model No.		
	(ii) Country of Origin		
	(iii) Dimension and Resolution		
(g)	PLC Programming software		
	(i) Software Details		
	(ii) Make & Model		
(i)	Interposing Relays with base terminal		
	(i) Make & Model		
3.1.24	SCADA Software (Dual – Redundant configuration)		
(a)	(i) Software Details		
	(ii) Un-Limited Tags		
	(iii) Limited Tags		
(b)	Operator & Engineering work stations PC's:		
	a. CPU Configuration		
	b. Model		
	c. Monitor Configuration		
	d. Make		

S. No	Description	Unit	Particulars
(c)	Commercial grade server PC's a. CPU Configuration b. Model c. Monitor Configuration d. Make		
3.1.25	Historian Software (i) Make (ii) Model No		
3.1.26	Printers & Printer Server (i) OFFLINE (ii) ONLINE		
3.1.27	RIO Modules along with Panels (i) Make (ii) Model No		
3.1.28	SMPS for Automation System (i) Make (ii) Model No		
3.1.29	Control Panels with internal wiring and Local Control Panels (i) Make and Model (ii) Pre-Fabricated		
3.1.30	Instrumentation (Analog) & Control Cables and Power Cables, OFC, Trays, Glands & Lugs, cable conduits (i) Make (ii) No of Cores (iii) Type (iv) Size (iv)Country of Origin		

S. No	Description	Unit	Particulars
3.1.31	62" LCD Screen with accessories and Commercial Grade PC (i) Make & Model (ii) Dimension(Size) (iii) Resolution		
3.1.32	Private Automatic Branch Exchange (PABX) System & No. of Extensions with Telephone Instruments (i) Make & Model (ii) Number of Extension with PABX system (iii) Quantity		
3.1.33	Redundant FOC equipment +cabling +Insulated Pipes on conduits (i) Make (ii) Type (iii) Country of Origin		
3.1.34	System console/SCADA furniture (i) Make (ii) Type		
3.1.35	Uninterruptable Power Supply (i) Make and Model (ii) Capacity (iii) Redundancy (iv) No. of batteries (v) Rating		

Make & Model List

Sr.No.	Item	Qty	Make & Model	Supporting document submitted (YES/NO)
1	47" or above LED (Diagonally) for 3 x 3 Matrix - HD Video Wall	9		
2	Wall Mounting Kit for 3 x 3 Video Wall with Standing Metal Wall	1		
3	Remote Sensing Device for controlling of Video Wall	1		
4	Video Wall Digital Controller	1		
5	Video Wall Engine	1		
6	Application Software - GUI Interface	1		
7	Speakers	5		
8	Power Amplifier	1		
9	Input / Output Switcher	1		
10	HDMI Matrix Control Switcher	1		
11	Digital Video Scalar	1		
12	Video Data Flipper	1		
13	Supervisory Suite and Server	1		
14	Tran receiver	1		
15	24 Port Switch	1		
16	Distribution Amplifier	1		
17	Connectors / Cables and Accessories (in Lot)	1		
18	Rack	1		
19	HD Graphics peripheral Card	4		

7 C 4. SUB-SECTION

TECHNICAL SCHEDULE IV ELECTRICAL WORKS

TECHNICAL SCHEDULE IV
ELECTRICAL WORKS
(To be completed by the Tenderer)

4.1 High Voltage Metal Enclosed Switchboards

Sr. No.	Description	Unit	Technical Particulars
4.1.1	Make		
4.1.2	Type		
4.1.3	Applicable Standards		
4.1.4	Quantity	No.	
4.1.5	Dimensions	mm x mm x mm	
4.1.6	Switchgear cubicles and Bus bar ratings		
(a)	Rated voltage, phases and frequency		
(b)	System Neutral Earthing		
(c)	Maximum system voltage	kV	
(d)	One minute power frequency withstand voltage	kV (rms)	
(e)	12/50 μ sec impulse withstand voltage	kV (peak)	
(f)	Short circuit withstand		
(i)	Short time (1 sec) at rated voltage	kA(rms)	
(ii)	Dynamic rating	kA(peak)	
(g)	Reference ambient temperature		
(h)	Maximum temperature of bus bars droppers connectors and contacts at continuous current rating under site reference ambient temperature		
(i)	Continuous current rating of bus bar	A	
(j)	Bus bar material		
(k)	Bus bar Insulation		
(l)	Cable entry		
(m)	Cable type for Incoming and Outgoing feeders		
4.1.7	Switchgear constructional Requirement		
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partitions	mm	

Sr. No.	Description	Unit	Technical Particulars
(b)	Degree of protection		
(c)	Colour finish shade		
(d)	Earthing bus	i) Material	
		ii) Size	mm x mm
(e)	Earthing conductor	i) Material	
		ii) Size	mm x mm
4.1.8	Breaker Particulars		
(a)	Circuit breaker type		
(b)	Voltage, phases and frequency		
(c)	Rated operating duty		
(d)	Rated current at reference ambient temperature		
	(i) Incoming breakers	A	
	(ii) Outgoing breakers	A	
(e)	Rated breaking capacity	kA (rms)	
(f)	Rated making current	kA (peak)	
(g)	Short time current withstand for 1 sec duration	kA (rms)	
(h)	Total break time		
(i)	Operating mechanism type (Normal)		
	Operating mechanism type (Emergency)		
(j)	Minimum no. of auxiliary contacts		
(k)	Withstand test voltage		
	(i) One minute power frequency	kV (rms)	
	(ii) 1.2/50 μ sec impulse	kV (peak)	
(l)	Auxiliary control voltage		
	(i) For closing / tripping coil		
	(ii) For spring charging motor		
	(iii) For space heaters and lighting		
(m)	Anti pumping feature		
(n)	Latching requirement		

Sr. No.	Description	Unit	Technical Particulars
4.1.9	Current Transformers		
(a)	Type		
(b)	Class of insulation		
(c)	Rated current ratio and burden		
(i)	Incomers and bus couplers		
(ii)	Outgoing feeders		
(d)	Accuracy class		
(i)	Metering		
(ii)	Protection		
(e)	Short time 1 sec current rating	kA (rms)	
(f)	Dynamic rating	kA (peak)	
4.1.10	Voltage Transformers		
(a)	Type		
(b)	Rated Voltage		
(i)	Primary	V	
(ii)	Secondary – S1	V	
(c)	Method of connection		
(i)	Primary – P		
(ii)	Secondary – S1		
(d)	Application – S1		
(e)	Rated burden	VA	
(f)	Accuracy class		
(g)	Rated voltage factor		
(i)	Continuous		
(ii)	Short time		
(h)	Insulation class		
)	Meters		
	Make		
(b)	Accuracy Class		
	(i) Indicating Meters		
	(ii) Energy Meter		
4.1.11	Protective Relays		
	Type		
	Auxiliary supply		
4.1.12	Annunciations Provided for 11kV Metal enclosed Switch board		
a	At STP substation		
b	At TSPS Substation		

Sr. No.	Description	Unit	Technical Particulars
c	AT Air Blower Bldg		
d	At DG Switchgear at substation near DG room		
e	At Switchgear at substation near Bio-Gas ancillary room		
4.1.13	Whether Cubicle Components Provided as per Part 12 -Particular Electrical Requirement of Specification	Yes / No	
4.1.14	Auxiliary A.C. Supply Voltage & Frequency	V, Hz	
4.1.15	Whether all the above details attached for all Switchgear cubicles at locations mentioned as per 5.1.13	Yes /No	

4.2 Distribution Transformers

4.2.1	Manufacturer		
4.2.2	Full load rating	KVA	
4.2.3	Number of Phases	One/ Three	
4.2.4	Rated no-load voltage		
	a) HV	KV	
	b) LV	KV	
4.2.5	Type of Cooling		
4.2.6	Rated percentage impedance	%	
4.2.7	Winding connections		
	a) HV		
	b) LV		
	c) Vector group		
4.2.8	Tapping on winding		
	a) On load/off load tap		
	b) Total tapping range	%	
	c) Tapping steps		
	d) On HV/LV windings		
4.2.9	Maximum temperature rise of		
	a) Oil by thermometer	⁰ C	
	b) Windings by resistance method	⁰ C	

4.2.10	Load loss at rated current at 75°C winding temperature (guaranteed, subject to + tolerance as per applicable standard)	KW	
4.2.11	No-load losses (core loss and dielectric loss) at 100% rated voltage and frequency, subject to + tolerance as per applicable standard	KW	
4.2.12	Magnetization current at rated voltage and frequency in percent of full load current	%	
4.2.13	Weight		
4.2.14	Windings	Kg	
4.2.15	Core	Kg	
4.2.16	Oil	Kg	
4.2.17	Tank, coolers & fittings	Kg	
4.2.18	Total (5.2.13.1 TO 5.2.13.4)	Kg	
4.2.19	Efficiency at 75°C Full Load, U.P.F.	%	
4.2.20	Maximum Flux Density		
4.2.21	At rated voltage	Wb/m ²	
4.2.22	At 110% of rated voltage	Wb/m ²	
4.2.23	Drawing number of the general outline drawing enclosed with the bid, showing the transformer with all its fittings and accessories in plan, front and side elevations and other relevant details.		

4.3 FCMA Starter Panel

Sr. No.	Description	Unit	Technical Particulars
4.3.1	Quantity	Nos.	
4.3.2	FCMA Neutral Soft Start Panel and Busbar Rating		
(a)	Rated voltage phases and frequency		
(b)	Motor rating	kW	
(c)	System neutral earthing		
(d)	Maximum system voltage	kV	
(e)	One minute power frequency withstand voltage	kV (rms)	

Sr. No.	Description	Unit	Technical Particulars
(f)	1.2/50 micro sec. impulse withstand voltage	kV (peak)	
(g)	Short circuit withstand		
	(i) Short time (1 sec) at rated voltage	kA (rms)	
	(ii.) Dynamic rating	kA (peak)	
(h)	Reference ambient temperature	° C	
(i)	Maximum temperature of busbars droppers connectors & contacts at continuous current rating under site reference ambient temperature		
(j)	Method of connection		
4.3.3	FCMA Neutral Soft Start Panel Particulars		
(a)	Bus bars rating and material		
(b)	Bus bar insulation		
(c)	Cable entry		
4.3.4	FCMA Neutral Soft Start Panel Constructional Requirement		
(a)	Thickness of sheet steel		
	(i) Frame, Frame enclosures, doors, covers and partition	mm	
(b)	Degree of protection		
(c)	Colour finish shade		
(d)	Earthing bus	Material	
		Size	mm x mm
(e)	Earthing conductor	Material	
		Size	mm x mm
(f)	Type of cooling for winding	-	
4.3.5	Auxiliary Supply		
(a)	Control		
(b)	Space heater & lighting		

Sr. No.	Description	Unit	Technical Particulars
4.3.6	Current Transformer		
(a)	Type		
(b)	System voltage & freq.		
(c)	Class of insulation		
(d)	Rated current ratio and burden		
(e)	Accuracy class Metering Protection		
(f)	Short time 1 sec. Current rating & dynamic rating	kA (rms) kA (peak)	
4.3.7	Differential Relay		
(a)	No. of poles		
(b)	Setting range % rated current		
(c)	No. of contacts		
(d)	Reset type		
(e)	Flag indicator		
(f)	Coil rating	A	
4.3.8	Following Requirement shall be provided in panel		
(a)	Starting interlock with incomer 11 kV vacuum contactor		
(b)	Trip circuit		
(c)	Running mode signal		

4.4 Metal Enclosed Switchgears PCC/MCC

Sr. No	Description	Unit	Technical Particulars
4.4.1	Make		
4.4.2	415 V Switchgear And Busbar Ratings		
(a)	Rated voltage phase and frequency		
(b)	System Neutral Earthing		
(c)	Maximum system voltage	V	
(d)	One minute power frequency voltage		
	i) Power circuits	V	
	ii) Control circuits	V	

Sr. No	Description	Unit	Technical Particulars
	iii) Aux. Circuits connected to Sec of CTS	V	
(e)	Continuous current rating of Busbars under site reference Ambient Temperature and type & material	Rating Material	
(f)	Busbar insulation		
(g)	Reference Ambient Temperature	° C	
(h)	Maximum Temperature of Busbars, Droppers and Contacts at Continuous current rating under site ambient temperature	° C	
(i)	Short Circuit current withstand for Busbars and droppers (i) Short time 1 sec	kA (RMS)	
	(ii) Dynamic Rating	kA (Peak)	
4.4.3	Switchgear Constructional Requirement		
(a)	Type of Construction		
(b)	Thickness of sheet steel (i) Frame, Frame enclosures, doors, covers and partitions	mm	
(c)	Degree of protection		
(d)	Colour finish shade		
(e)	Earthing bus	Material	
		Size	mm x mm
	Earthing conductor	Material	
		Size	mm x mm
(g)	Minimum clearances in air of live parts (i) Phase to Phase	mm	
	(ii) Phase to Earth	mm	
(h)	Cable entry to cubicles		
4.4.4	Change over Switch		
(a)	Applicable Standards		
(b)	Quantity	No.	
(c)	Rating	A	
(d)	Short circuit current capacity for 1 sec	kA (rms)	

Sr. No	Description	Unit	Technical Particulars
(e)	Provision of Safety Key Lock	Yes /No	
(f)	Auxiliary Contacts		
4.4.5	Instrumentation Transformers		
(a)	Current transformer		
	(i) Ratio		
	(ii) Burden	VA	
	(iii) Accuracy Class		
(b)	Voltage transformer		
	(i) Ratio		
	(ii) Burden	VA	
	(iii) Accuracy Class		
4.4.6	Whether all the above details attached for all Switchgear cubicles at Process Air Blower Building	Yes /No	

4.5 415 V Power Capacitor and Control Panel

Sr. No	Description	Unit	Technical Particulars
4.5.1	General		
(a)	Make		
(b)	Rated Capacity	KVAR	
(c)	Rated voltage	V	
(d)	Rated frequency and phases		
(e)	Ambient temperature	° C	
(f)	Cable gland required		
(g)	Type of cable		
(h)	Size of cable		
(i)	Cable entry		
4.5.2	Constructional Requirement		
(a)	Thickness of sheet steel i) Frame, Frame enclosures, doors covers and partition	Mm	
(b)	Degree of protection		
(c)	Colour finish shade		
(d)	Earthing bus	Material	
		Size	mm x mm

Sr. No	Description		Unit	Technical Particulars
(e)	Earthing conductor	Material		
		Size	mm x mm	
4.5.3	Design Requirement			
(a)	Insulation level		kV (rms)	
(b)	Capacitor bank connection			
(c)	Short circuit withstand for busbars			
	i) Short time (1 sec)		kA (rms)	
	ii) Dynamic		kA (peak)	
(d)	Type of switching			
(e)	Switching steps			
(f)	Switch and Rating of contactor			
(g)	Incomer MCCB current rating			
(h)	O/L capacity of capacitors			
(i)	O/V capacity of capacitors			
(j)	Protections			

4.6 Diesel Standby Generator Sets

Sr. No.	Description		Unit	Technical Particulars
4.6.1	General			
(a)	Set Manufacturer			
(b)	Quantity & Type			
(c)	Applicable Standard			
(d)	Rating			
(e)	Provision of AMF Control Panel		Yes/ No	
(f)	Provision of Synchronising Panel		Yes/ No	
4.6.2	Alternator			
(a)	Manufacturer			
(b)	Type			
(c)	Applicable Standard			
(d)	Rating		KVA	
(e)	Voltage		V	
(f)	Number of phases			
(g)	Frequency		Hz	
(h)	Power Factor			
(i)	Rated Current		A	

Sr. No.	Description	Unit	Technical Particulars
(j)	Overload Capacity		
(k)	Class of Insulation		
(l)	Degree of protection		
(m)	Winding Connection		
(n)	Short circuit current		
(o)	Type of rotor bearings		
(q)	Provision of temperature sensors in stator windings		
(r)	Exciter		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(s)	AVR		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(t)	Voltage regulation		
(u)	Outgoing Cable		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	Size		
4.6.3	Diesel Engine		
(a)	Manufacturer		
(b)	Type		
(c)	Applicable Standard		
(d)	Rating	HP	
(e)	Speed	RPM	
(f)	Number of Cylinders		
(g)	Number of Strokes		
(h)	Type of Starting		
(i)	Duty		
(j)	Overload Capacity		
(k)	Radiator		
	(i) Make		
	(ii) Type		
	(iii) Fan power		
	(iv) Cooling air flow		
(l)	Exhaust system		

Development of Major Arterial Road, Phase -1 in Nada Prabhu Kempegowda Layout

Sr. No.	Description	Unit	Technical Particulars
	(i) Type of Silencer		
	(ii) Exhaust temperature gauge range		
(m)	Governor		
	(i) Make		
	(ii) Type		
	(iii) Applicable Standard		
	(iv) Class of governor		
(n)	Cooling Water System		
	(i) Water temperature		
	(ii) Water Pressure		
	(iii) System Capacity		
	(iv) Provision of High water temperature and low water level switches		
(o)	Lubricating oil system		
(i)	Grade of Oil		
(ii)	Oil Pressure		
(iii)	Oil temperature		
(iv)	Sump Capacity		
(v)	Oil Consumption per 100 hours		
(vi)	Recommended time period of Oil Change		
(p)	Fuel		
(i)	Fuel Specification		
(ii)	Fuel Consumption at rated Capacity		
(q)	Day oil tank		
(i)	Capacity	Litres	
(ii)	Provision of Level Gauge		
(r)	Bulk Storage tank		
(i)	Location		
(ii)	Type		
(iii)	Capacity		
4.6.4	AMF Control Panel		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	Constructional Features		
(a)	Thickness of sheet steel		

Development of Major Arterial Road, Phase -1 in Nada Prabhu Kempegowda Layout

Sr. No.	Description	Unit	Technical Particulars
	Frame, Frame enclosures, doors covers and partition	mm	
(b)	Colour finish shade - Interior		
(c)	Colour finish shade - Exterior		
(d)	Degree of Protection		
(v)	AMF Features Provided as per Technical Specification	Yes/No	
4.6.5	Protections, Alarm, Indications & Control whether provided as per Specification	Yes/No	
4.6.6	Synchronising Panel		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	Constructional Features		
(a)	Thickness of sheet steel Frame, Frame enclosures, doors covers and partition	mm	
(b)	Colour finish shade - Interior		
(c)	Colour finish shade - Exterior		
(d)	Degree of Protection		
(v)	Synchroscope		
(a)	Make		
(b)	Type		
(c)	Applicable Standard		
4.6.7	Acoustic Enclosure		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	Constructional Features		
(a)	Thickness of sheet steel Frame, Frame enclosures, doors covers.	mm	
(b)	Degree of Protection		
(c)	Acoustic material		
(iv)	Sound level at 1m distance		
(v)	Whether certified to meet emission	Yes/No	

Sr. No.	Description	Unit	Technical Particulars
	norms		
4.6.8	Battery		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	Voltage		
(v)	Capacity at 10 hours rate		
(vi)	Number of successive starting permissible		
4.6.9	Battery Charger		
(i)	Make		
(ii)	Type		
(iii)	Applicable Standard		
(iv)	AC Input to Charger		
(v)	DC Output of Charger		

4.7 Variable Frequency Drives

Sr. No.	Description	Unit	Technical Particulars
4.7.1	General		
(a)	Make		
(b)	Type		
(c)	Applicable Standard		
(d)	Drive Application		
(e)	Quantity	Nos.	
(f)	Type of converters		
(g)	Inverter capacity at specified pf		
(h)	Rated Current		
(i)	Load power factor		
(j)	Max. continuous current		
(k)	Rated voltage with number of phases		
(m)	Rated frequency		
(n)	Converter Bridge		
(o)	Single Quadrant/Two quadrant/ Four Quadrant		
4.7.2	Control Characteristics		
(a)	Speed Control		

Sr. No.	Description	Unit	Technical Particulars
(b)	Rated speed		
(c)	Speed ratio		
(d)	Constant torque/constant power		
(e)	Speed accuracy		
(f)	Closed loop/open loop		
(g)	Accel./Deccel. time		
(h)	Possibility of Remote Operation	Yes / No	
4.7.3	Overall Harmonic Limitation	%	
4.7.4	Braking		
(a)	Type of braking		
(b)	Braking Torque		
4.7.5	Miscellaneous		
(a)	Soft-start	Yes/No	
(b)	Flying restart	Yes/No	
(c)	Auto restart	Yes/No	
(d)	Kinetic Buffering	Yes/No	
4.7.6	Confirm whether following minimum Indications on Drive Panel are Provided	Yes/No	
(a)	Motor running		
(b)	Motor stopped / trip		
(c)	AC mains 'ON'		
(d)	System Ready to start		
(e)	VFD system fault		
4.7.7	Confirm whether Digital Display of following Minimum parameters on the Drive Panels:-	Yes/No	
(a)	Input AC Voltage		
(b)	Input AC Frequency		
(c)	Input AC Current		
(d)	Output Voltage		
(e)	Output Current VFD/Bypass		
(f)	Output Frequency		
(g)	Motor speed		
(h)	Whether Necessary transducers provided for indicating motor speed & current in PLC/DCS.	Yes/No	

4.8 Battery

Sr. No.	Description	Unit	Technical Particulars
4.8.1	Make		
4.8.2	Type of battery		
4.8.3	Applicable Standards		
4.8.4	Number of battery banks required		
4.8.5	Ambient conditions		
4.8.6	D.C. system voltage	V	
4.8.7	Ampere hour capacity of battery at 27 Deg. C at 5 hour rate to give final cell voltage of 1.16 volts/cell	Ah	
4.8.8	Momentary load/duration	A	
4.8.9	Emergency load/duration	A	
4.8.10	Continuous load/duration	A	
4.8.11	Nominal voltage	V	
4.8.12	Cell voltage - initial/final	V	
4.8.13	Number of cells per bank required to give rated voltage	Nos.	
4.8.14	Number of spare cells per bank	Nos.	
4.8.15	Overall dimensions		
a	Each Cell (L x W x H)	mm x mm x mm	
b	Complete battery in the rack	mm x mm x mm	
4.8.16	Mounting arrangement		
4.8.17	Charging method		

4.9 Battery Charger

Sr. No.	Description	Unit	Technical Particulars
4.9.1	General		
(a)	Make		
(b)	Applicable Standards		
(c)	Number required (i) Battery charger	Nos	
(d)	Rated Output voltage (DC)	V	
(e)	Rated Output	kW	

Sr. No.	Description	Unit	Technical Particulars
(f)	DC System Earthing		
(g)	Voltage regulation from no load to rated load	%	
(h)	Ambient Design Temperature	Deg. C	
(i)	Busbar material & size	-	
(j)	Overall dimensions	mm x mm x mm	
4.9.2	Battery Details		
(a)	Float/Trickle charging current of battery	mA	
(b)	Boost Charging Current of Battery (Maximum)	A	
(c)	Boost Charging Voltage of Battery (maximum)	V	
(d)	Maximum Time for Boost charging of Battery	hr	
(e)	Battery capacity & no. of cells	Ah	
		Nos.	
4.9.3	AC System Data		
(a)	Supply Voltage	V	
	Phase		
(b)	(i) Variation in supply Voltage	%	
	(ii) Variation in supply frequency	%	
(c)	Short Circuit level	kA	
(d)	Type of earthing		
4.9.4	Performance		
(a)	DC voltage setting adjustment for float charger		
(b)	Voltage stabilisation for constant voltage regulator		
(c)	Maximum permissible variation in DC voltage (no load to full load)		
(d)	D.C. voltage setting adjustment for boost charging		
(e)	D.C. current adjustment for boost Charging		
(f)	Current stabilisation for constant current regulator for boost charger		
(g)	Minimum permissible power factor to rated continuous load		
(h)	Permissible ripple content at rated continuous load		

Sr. No.	Description	Unit	Technical Particulars
(i)	Relay for auto changeover from Float to boost mode to be provided (in case of float-cum-boost charger)		
4.9.5	Constructional Features		
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partition	mm	
(b)	Degree of protection		
(c)	Colour finish shade		
(d)	Earthing bus	Material	
		Size	mm x mm
(e)	Earthing conductor	Material	
		Size	mm x mm
(f)	Cable entry		
(g)	Cable Sizes		
	(i) Battery	sq.mm	
	(ii) DC output	sq.mm	
	(iii) AC input	sq.mm	

4.10 DC Distribution Board

Sr. No.	Description	Unit	Technical Particulars
4.10.1	General		
(a)	Make		
(b)	Applicable standards		
(c)	DC System voltage (Nominal)	V	
4.10.2	DC System Earthing		
4.10.3	Ambient Design Temperature	Deg. C	
4.10.4	Bus bar material , rating and size		
4.10.5	DC Bus Load		
(a)	Total continuous DC load	A	
(b)	Short time loads (Additional to continuous loads)		
	(i) DC lights/Facia lamps	A	
	(ii) Starting current and duration of Largest Connected DC Motor	A	
		Secs	

4.10.6	Constructional Features			
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partition		mm	
(b)	Degree of protection			
(c)	Colour finish shade			
(d)	Earthing bus	Material		
		Size	mm x mm	
(e)	Earthing conductor	Material		
		Size	mm x mm	
(f)	Cable entry			
(g)	Cable Sizes			
	(i) DC Input from Battery		sq.mm	
	(ii) DC output to Load		sq.mm	

4.11 Non Segregated Bus Duct

Sr. No.	Description	Unit	Technical Particulars
4.11.1	Type of Bus Duct		
4.11.2	Type of Cooling		
4.11.3	Installation		
4.11.4	Nominal Service Voltage	V	
4.11.5	Rated Voltage Class	V	
4.11.6	Continuous Current Rating of Bus Ducts under Site Conditions	A	
4.11.7	One minute Power Frequency Withstand Voltage	V	
4.11.8	Momentary Current Rating	kA	
4.11.9	Short Time Current Rating for one second - kA (RMS)	kA	
4.11.10	Maximum Temperature (Hot Spot) of Busbars at Rated Current - °C		
4.11.11	Maximum Temperature (Hot Spot) of Enclosure at Rated Current °C		
4.11.12	Busbar Material		
4.11.13	Busbar Section		
4.11.14	Bus Enclosure Material		
4.11.15	Shape of Enclosure		
4.11.16	Phase Clearance (Minimum) Phase to Phase Phase to Earth	mm mm	
4.11.17	Type of Joints between Adjacent Sections of Bus Conductor Welded/Bolted		

4.12 Cable

Sr. No.	Description	Unit	Technical Particulars
4.12.1	11kV (UE) XLPE Insulated Power Cables		
(a)	Make		
(b)	Type		
(c)	Applicable Standards		
(d)	Cable size selection whether done as per Specification	Yes /No	
(e)	Continuous current rating with cable laid in air/ground under specified ambient temperature	A	
(f)	Conductor material		
(g)	Conductor screening		
(h)	Insulation		
(i)	Screening on Insulation		
(j)	Identification of codes		
(k)	Inner sheath		
(l)	Filler material		
(m)	Armouring		
(n)	Outer sheath		
(o)	Overall diameter of the cable	mm	
(p)	Recommended minimum bending radius	mm	
(q)	Standard length of cable on each drum	mts	
4.12.2	1100 V Grade XLPE Insulated Power Cables		
(a)	Make		
(b)	Type		
(c)	Applicable Standards		
(d)	Cable size selection whether done as per Specification	Yes /No	
(e)	Conductor material		
(f)	Insulation		
(g)	Inner sheath		
(h)	Armouring		
(i)	Outer sheath		
(j)	Overall diameter of cable		
(k)	Recommended minimum bending radius	mm	
(l)	Standard length of cable on each drum	mts	
4.12.3	1100 V Grade PVC Insulated Power Cables		
(a)	Make		
(b)	Type		
(c)	Applicable Standards		
(d)	Cable size selection whether done as per Specification	Yes /No	

Sr. No.	Description	Unit	Technical Particulars
(e)	Recommended minimum bending radius	mm	
(f)	Standard length of cable on each drum	mts	
4.12.4	650/1100 V Grade PVC Insulated Control Cables		
(a)	Make		
(b)	Type		
(c)	Applicable Standards		
(d)	Rated voltage		
(e)	Cable size selection		
(f)	Conductor material		
(g)	Insulation		
(h)	Inner sheath		
(i)	Armouring		
(j)	Outer sheath		
(k)	Standard length of cable on each drum	mts	

4.13 Lighting Fixtures and Accessories

Sr. No.	Description	Unit	Technical Particulars
4.13.1	General		
(a)	Illumination levels at various premises whether considered as per Specification	Yes /No	
(d)	Normal supply voltage, phase and frequency	AC	
		DC	
(e)	Variation in supply:		
	(i) Voltage (AC & DC)	%	
	(ii) Frequency	%	
	(iii) Combined voltage & frequency	%	
(f)	Design ambient air temperature	°C	
4.13.2	Luminaire terminal suitable for		
(a)	Indoor area		
	(i) Conductor material		
	(ii) Cable size	Coresxm m ²	
(b)	Outdoor area		
	(i) Conductor material		

Sr. No.	Description	Unit	Technical Particulars
	(ii) Cable size	Cores xmm ²	
4.13.3	Luminaire earthing terminal suitable for		
	(i) Conductor material		
	(ii) Conductor size	SWG	
4.13.4	Luminaires		
(i)	High Power Discreet LED Luminaries		
(a)	Make		
(b)	Type		
(c)	Rating		
(ii)	High Power Discreet LED Luminaries		
(a)	Make		
(b)	Type		
(c)	Rating		
(iii)	Flood Light Luminaires		
(a)	Make		
(b)	Type		
(c)	Rating		

4.14 Lighting System and Equipment

Sr. No.	Description	Unit	Technical Particulars
4.14.1	System Particular		
(a)	Voltage		
	(i) 3 Phase, 4 wire 50 Hz system		
	• Rated	V	
	• Maximum	V	
	• One minute withstand voltage		
	(ii) D.C. system		
	• Rated	V	

Sr. No.	Description	Unit	Technical Particulars
(b)	System short-circuit level		
	(i) At 415 V, A.C.	kA (RMS)	
	(ii) At 110 V.D.C.	kA (D.C.)	
(c)	Reference ambient temperature	⁰ C	
4.14.2	Distribution Board/Panels		
(a)	Main, floor mounted distribution boards		
(i)	Main Lighting distribution board(A.C.)		
	• Make		
	• Type		
	• Degree of protection		
	• Bus bar material		
	• Bus bar current rating	A	
	• Short circuit current rating	kA	
	• Details of Incoming and Outgoing feeders		
	• Cable entry		
	• Location		
(ii)	Emergency lighting panel (D.C.)		
	• Make		
	• Type		
	• Degree of protection		
	• Bus bar material		
	• Bus bar current rating	A	
	• Short circuit current rating	kA	
	• Details of Incoming and Outgoing feeders		
	• Cable entry		
	• Location		
(iii)	Single phase Lighting DBs (SLDBs), Three Phase lighting DBs (TLDBs) / Wall/ Structure mounting		

Sr. No.	Description	Unit	Technical Particulars
	SLDB/TLDB for indoor area		
	• Make		
	• Type		
	• Details of Incoming and Outgoing feeders		
	• Degree of Protection		
(iv)	SLDB/TLDB for outdoor area		
	• Make		
	• Type		
	• Details of Incoming and Outgoing feeders		
	• Degree of Protection		
(v)	Paint Finish		
	(i) Colour shade:		
a)	Street Light Poles And Flood Light Poles Street Light Pole		
	Type		
	Total Height:	MTRS	
	Quantity:	Nos.	
(b)	Floodlight Light Pole		
	Type		
	Total height :	MTRS	
	Quantity:	Nos.	
	No. Of floodlights to be fixed per pole	No.	

4.15 Earthing and Lightning Protection System

Sr. No.	Description	Technical Particulars		
		Size	Material	No.of Leads & Quantity
(a)	Main Earthing Grid Buried in earth			
(b)	Buried in floor slabs in buildings			
4.15.1	Conductor Leads To Equipment (above ground)			
(a)	Transformers			
(i)	Transformer neutral to bottom of tank			
(ii)	From bottom of tank to earth grid			
(iii)	Transformer tanks and radiator bank			

Sr. No.	Description	Technical Particulars		
(b)	Diesel Generator Set			
(i)	DG Set neutral earthing			
(ii)	DG Set body earthing			
(c)	Fence posts and gates (Flex. braid)			
4.15.2	11kVMetal Enclosed Switchboard, 415Vswitchgear/ MCC.			
4.15.3	Motors			
(a)	415V Motors above 10 kW			
(b)	415V Motors up to 10 kW			
(c)	Fractional horse power motors			
4.15.4	Other Items			
(a)	Capacitor panel, Battery charger panel, DC distribution board , Main lighting D.B, Control panels and sub-lighting distribution boards etc			
(b)	Hand Rails			
(c)	Cable trays			
(d)	Tanks			
(e)	Junction boxes			
(f)	Lighting fixtures, receptacles, lighting conduits			
(g)	Push button stations, limit switches			
4.15.5	Crane rail			
4.15.6	Street lighting, flood lighting poles and junctions boxes			
4.15.7	Metallic noncurrent carrying structures			
4.15.8	Lightning Conductors			
(a)	Lightning protection down comers for building			
(b)	Lightning protection horizontal roof conductor for building			
4.15.9	Electrodes			
(a)	Pipe electrode			

7 C 5. SUB-SECTION

TECHNICAL SCHEDULE V

QUALITY ASSURANCE & QUALITY CONTROL PLAN

TECHNICAL SCHEDULE V

QUALITY ASSURANCE & QUALITY CONTROL PLAN

(To be completed by the Tenderer)

The Bidder shall provide copies of the company's standard rules and regulations regarding Quality Assurance and Quality Control procedures for works in general and works of a similar nature.

The Bidder shall provide its proposed Quality Assurance and Quality Control Plan in detail so as to demonstrate the procedures and tests that will be used to ensure that the quality concerns and requirements as set forth in Volume 2 Employer's Requirements; Section 7 are satisfactorily met.

The proposed plan will describe but not limited to:

- the type, frequency and procedure of tests to be done on site(s);
- type, frequency and procedure of tests to be done in pipe manufacturing units at site(s), if applicable;
- type, frequency and procedure of tests to be done at manufacturers' locations outside the site(s);
- all parameters to be measured in these tests; permissible limits of such parameters; details of laboratories to be established at site(s); details of testing equipments & machines and their calibration schedules
- details of the Bidder's internal systems for assuring quality control at the manufacturers' works outside the site(s);
- details of qualifications and experience of the Quality Control professionals to be deployed for the entire project; and
- the systems of Quality Audit to be instituted for systematic and professional management as well as adherence with the highest standards of quality of all construction works.
- All the tests of samples taken from the site(s) are proposed to be done through recognized test houses of international standards and number of samples and frequency of sampling of materials brought to the site(s) and the products manufactured at site(s) shall be as per I.S. Specifications. All such samples shall be taken in the presence of Employer's authorized representatives.

The Bidder shall provide separate descriptions of its proposed QA/QC plan during the construction phase and the subsequent operations and maintenance phase.

This will be an initial QA/QC plan which will address to basic requirements of Quality control and Quality assurance of the works.

7 C 6. SUB-SECTION

TECHNICAL SCHEDULE VI ENVIRONMENTAL MANAGEMENT PLAN

TECHNICAL SCHEDULE VI
ENVIRONMENTAL MANAGEMENT PLAN

(To be completed by the Tenderer)

Name of the Tenderer

The Bidder shall provide his proposed Environmental Management Plan in detail so as to demonstrate the procedures that will be used to ensure that the environmental concerns and requirements as set forth in Volume 2 Employer's Requirements are satisfactorily met.

The Environment Management Plan shall identify the potential environmental impacts from the various construction and operations and maintenance activities to be undertaken in the Contract and set out in detail the approach that will be adopted in mitigating these environmental impacts to ensure that the residual impacts are minor and confined to a short period.

While preparing the proposed Environmental Management Plan the Bidder shall consider but not be limited to the following:

- The Bidder shall pay attention to the methods of materials delivery, storage, usage and disposal; equipment usage; and site activities to ensure they have minimal impact on the environment,
- The Bidder shall propose only environmentally safe products and practices in performing his works, and
- The Bidder shall comply with all of the statutes regarding environmental effects.

The Bidder shall provide separate descriptions of its proposals for minimizing any adverse environmental impacts/effects during the construction phase and the subsequent operations and maintenance phase.

This will be an initial Environmental Management Plan (EMP) which will address all moderate and significant negative impacts of the construction and operation and maintenance activities to be performed in the contract.

7 C 7. SUB-SECTION

TECHNICAL SCHEDULE VII

SAFETY PLAN

TECHNICAL SCHEDULE VII

SAFETY PLAN

(To be completed by the Tenderer)

Name of the Tenderer

The Tenderer shall provide his proposed Safety Plan in detail so as to demonstrate compliance with the requirements set forth in Volume 2 Employer's Requirements; Section 7 are satisfactorily met.

The Safety Plan shall include a policy statement signed by the CEO or equivalent authority of the Organization declaring that Safety and loss prevention shall be given the highest practicable priority in all aspects of the Contract.

The Tenderer shall describe his proposed Safety Plan which shall be developed to ensure zero fatal accidents and zero hazardous incidents/occurrences in all construction works, including descriptions of the company's standard policies and procedures regarding its site organization and procedures implementations, methods and frequency of conducting safety audits/inspection at the Site(s), record keeping and reporting includes compliance reports and monthly reporting, timely corrective action implementation for the issues, supervising and monitoring to sustain the established safety management system, conducting safety review meetings, providing safety training for its personnel as required for all major critical activities of the sites, issue and mandatory use of safety equipment and penalties for non compliance to be adopted within contractor organizations, keeping the plant and equipments well maintained and details of the qualifications and experience of the Bidder's proposed Accident Prevention Officer(s) to be deployed at the Site(s).

The Tenderer shall provide separate descriptions of its proposed Safety Plan during the construction phase and the subsequent operations and maintenance phase.

This will be an initial Safety Plan which will address to the Health and Safety of the all persons entitled to be at Site(s) including the Employer's personnel.

7 C 8. SUB-SECTION

TECHNICAL SCHEDULE VIII

FUNCTIONAL GUARANTEES OF THE PLANT

TECHNICAL SCHEDULE VIII

FUNCTIONAL GUARANTEES OF THE PLANT

(To be completed by the Tenderer)

1 General

This document sets out the functional guarantees required to be provided by the Tenderer for assessing the performance of the Works. These guarantees shall be used by the Employer to evaluate Bidder's satisfactory performance during the Tests after Completion, and also throughout the Operation and Maintenance Period.

The Bidder shall complete the following sections and provide values for the electrical energy usage for the Works covered under the contract, based on the raw sewage flows and characteristics and effluent and sludge quality requirements as given in Section 7 (Specifications) of Volume 2 (Employer's Requirements).

2 Functional Guarantees

2.1 Effluent and Sludge Quality

The Bidder guarantees that the effluent and sludge quality requirements specified in Section 7 of Volume 2 will be fully and completely met, under either actual or simulated design raw sewage flows, loadings, and characteristics, as demonstrated by the Tests after Completion. The bidder further guarantees that the specified requirements will continue to be fully and completely met throughout the Operation and Maintenance Period.

2.2 Electrical Energy Usage

The Bidder guarantees that electrical energy usage of various components of the Works will not exceed the values listed in the table below, as demonstrated by the Tests after Completion and throughout the Operation and Maintenance Period. The actual electrical energy usage shall be directly metered and compared to guaranteed numbers on a monthly basis.

Item	Guaranteed not-to-exceed energy usage (PC_D) (kWh per Month)
STP Complete Works	
Total	

Item	Guaranteed Captive Power Generation (PG_D) not less than(kWh per Month)
STP Complete Works	

Net Guaranteed Power Consumption (Will be considered for Financial Bid Evaluation)

Item	Net Guaranteed Power Consumption = Energy usage PC_D minus (-) Captive Power Generation PG_D (kWh per Month)
STP Complete Works	
Total	

Note: Electrical Load List shall be provided for entire plant to arrive guaranteed power consumption, considering the minimum equipment requirements as per tender specifications.

In case the Tenderer fails to consider any of the above said factors. The Employer has the sole authority to do necessary corrections and consider revised figures for NPV Calculation during Evaluation of the Bid.

2.3 Energy Consumption and Generation during Operation and Maintenance Period

During operation and maintenance period the below formula will be applied for arriving the guaranteed power consumption based on actual flow and actual inlet sewage characteristics.

Symbol Definitions

The following symbol definitions shall apply for the subsequent clauses of this schedule:

PC_D = Guaranteed power consumption under design conditions for complete works, (kWh per day)

PC_A = Guaranteed not-to-exceed power usage under actual daily operating conditions for complete works, (kWh per day)

PG_D = Guaranteed power generation under design conditions for complete works, (kWh per day)

PG_A = Guaranteed not-to-exceed power generation under actual daily operating conditions for complete works, (kWh per day)

Q_{D1} = Design average influent sewage flow

Q_{A1} = Daily actual metered influent sewage flow for sewage treatment

Q_{D2} = Design average influent sewage flow

Q_{A2} = Daily actual metered influent sewage flow for sludge treatment

B_D = Design average influent sewage BOD concentration specified in bid document (mg/L)

B_A = Daily average of actual measured influent sewage BOD concentrations (mg/L)

T_D = Design average influent sewage TSS concentration specified in bid document (mg/L)

T_A = Daily average of actual measured influent sewage TSS concentrations (mg/L)

N_D = Design average influent sewage TKN concentration specified in bid document (mg/L)

N_A = Daily average of actual measured influent sewage TKN concentrations (mg/L)

V_D = Design average influent sewage VSS concentration specified in bid document (mg/L)

V_A = Daily average of actual measured influent sewage VSS concentrations (mg/L)

Guaranteed not-to-exceed power consumption under actual daily operating conditions for complete works to be calculated per formula below and result value shall be **Maximum of**
 $PC_A = [0.3 \cdot PC_D]$

Or

$$PC_A = \{[PC_D \cdot (Q_{A1}/Q_{D1})] \cdot \{(0.4 \cdot B_A/B_D) + (0.2 \cdot N_A/N_D) + (0.4 \cdot T_A/T_D)\}\}$$

Guaranteed not-to-exceed power generation under actual daily operating conditions for complete works to be calculated per formula below

$$PG_A = \{[PG_D \cdot (Q_{A2}/Q_{D2})] \cdot \{(0.2 \cdot B_A/B_D) + (0.8 \cdot V_A/V_D)\}\}$$

During operation and maintenance following table will be used for checking the guaranteed power consumption and guaranteed power generation on actual monthly basis

Days	For Complete Works	
	PC_A	PG_A
Day1		
Day2		
.....		
.....		
.....		
.....		
Day30		
Day31		
Total	ΣPC_A	ΣPG_A
Power consumption reading in a month should be less than or equal to ΣPC_A minus(-) ΣPG_A		