COOLING TOWER

Sr. No	Description	Code	Qty. Required
1	**<u>Cooling Towers</u>** Design heat load per cell = 3MW, Number of cells per tower = 2, : Range = 9°C,Approach = 4°C, Cold water basin, outlet channel/ sump & sludge pit =FG Shell I =Fiberglass **<u>Spare Parts:</u>** Fill of one cells, One set of blades, and Drift eliminator for one cell, Distribution nozzles for one cell. I Hardware 20%, Any other recommended by supplier	CT- 001-002	**2**

Sr. No.	Description	Code	Qty. Required
	Fills = Polypropylene /UV stabilized PVC / equivalent Fasteners/wetted parts = Stainless Steel		

Note: l: Quoted price will include the installation, testing and commissioning charges.

Note: 2: Specification of Cooling Towers is provided in attached Technical Specification.

Attachment 1

TABLE OF CONTENTS

1 PURPOSE

The purpose of this specification is to provide the basic requirements of cooling towers.

2 SCOPE

This technical specification defines and specifies the technical requirements and scope of supply for required two (02) cooling towers along with the required instrumentations, supports and spare parts.

2.1 SUPPLIER/MANUFACTURER SCOPE

a) The cooling tower shall be designed for continuous operation to cool not less than the design flow of water from specified inlet temperature to outlet temperature at a design ambient wet bulb temperature.

b) All the components shall be capable of safe, proper and continuous operation at all cooling water flows and shall be designed with regard to ease of maintenance, repair, cleaning and inspection.

c) The cooling tower shall be industrial, induced draft, cross flow type.

d) The vendor under this specification shall assume full responsibility in proper design and operation of each and every component of the cooling tower as well as the cooling tower as a whole unit.

e) The cooling tower shall be designed such that the drift losses and the evaporation losses are limited to the minimum.

f) The cooling tower structure shall be of adequate strength to withstand the wind load for wind speed of 48m/s and the effect of earthquake (0.18g) on the structure.

g) Vendor shall start fabrication only after approval of drawings by purchaser.

h) Vendor shall follow the safety rules & regulations and should take all safety precaution of their employee while executing the job on installation site.

i) Vendor shall box, crate, or package as necessary for shipment without charge unless otherwise specified on the Purchase Order.

j) The cooling tower shall be subjected to site acceptance test at installation site by demonstration of thermal rating capacity of cooling achieved.

k) After selection of proposal the qualified bidder is advised to visit the site before starting the design in order to get the idea of constraints and verify dimensions of layout. Any plea regarding unavailability of space and error in dimensions of provided space layout will not be entertained.

l) The cooling tower control will be provided in local control panel along with panels, wires, connections, marshalling etc.

3.2 SITE CONDITION

Maximum ambient temperature: 50 °C

Minimum ambient temperature: -1 °C

Wet Bulb Temperature 28 °C

Range 9 °C

Approach 4 °C

Relative Humidity: 24%-100%

3.3 SOFT WATER CHEMISTRY

Table 3-1: Water Chemistry Available for Cooling Towers at site

Sr. No.	Parameters	Soft Water
01	pH	8.0
02	Conductivity (μSCm^{-1})	≤ 400
03	Total Hardness	≤ 4
04	TDS	≤ 165
05	Calcium (ppm)	≤ 1
06	Magnesium (ppm)	≤ 0.4
07	Sulfate (ppm)	≤ 10
08	Chloride (ppm)	≤ 4
09	Sodium (ppm)	< 90
10	Silicon (ppm)	≤ 0.30
11	Iron (ppm)	< 0.04
12	Turbidity (NTU)	≤ 2

4 ELECTRICAL REQUIREMENTS

Provide factory furnished electrical control panel for each cooling tower for the operation/control and protection of cooling tower fans. With rated AC input Voltage 400V/50Hz.

Electrical Control panel shall be a factory pre-wired, field installed, wired (Halogen Free Flame Retardant Cables). NEMA 250 Type 3 – Drip-proof type enclosure, containing:

a) Incoming MCCB (ABB/ Siemens/ Schneider etc.) with short circuit current on the basis of source as 54kA and ModBus Serial Interface RS485 feature.

b) Outgoing MCCB (ABB/ Siemens/ Schneider etc.) for each Fan Motor.

c) Shielded, Halogen Free, Flame retardant cables for field connections

			from four possible directions .
17.		Stator Insulation	VPI insulation System design specifically for severe high humidity application with Class F Insulation System & class B temp. rise.
18.		Painting	Phenolic Rust Proof Base Plus Lacquer Surface Finished Painting in Pebble - Gray Color .
19.		Bolt Thread	ISO Metric System (Strength Category 8.8T) .
20.		Grounding Terminal	Two Terminals, One inside the Terminal Box another one Outside of the Frame.
21.	PERFORMANCE	Test Procedure	IEC 60034-2-1:2007 and Full Voltage Measuring Starting Performance.
22.		Winding Temperature Rise	Not to Exceed 80 °C Rise by Resistance Method at S.F 1.0 Operation with 03 Number Thermistor (RTD'S) installed in the winding
23.		Over Speed	120% Syn. R.P.M. for 2 Min.
24.		Over Torque	160% Rated Torque for 15 Sec .

i) Fans with motor over 20kW (20HP) shall include a vibration switch located in a protected position to effectively monitor fan vibration. Vibration switch shall be solid state with adjustable time delay. It shall stop fan motor under excessive fan vibration. Interface the vibration cut-out switches with control system to provide an alarm in the event the fans stop due to excessive vibration.

j) Complete wiring Diagram/Drawings.

k) Complete Specifications of Electrical components, devices and accessories.

l) 02 Sets of Spare Motors.

4 CODES & STANDARDS

The following Codes and Standards or equivalent form a part of this specification. The latest revision and / or addenda in effect on the date of the request for quotation shall apply unless later revisions are agreed by both parties.

a) ASME Code, Section II, "Material Specification",

b) PTC-23: ASME Performance Test Code for Atmospheric Water Cooling equipment.

c) BS-4485 – Specification for Water Cooling Tower.

d) Cooling Tower Institution of USA, Bulletin ATP-105: Acceptance Test Code for Industrial Water Cooling tower.

e) ASTM A 700 "Recommended Practice for Packaging".

f) Cooling Tower Institute.

g) Building code of Pakistan (Latest Revision).

If any of defect is found on material or performance are not met, the supplier shall repair, replace, modify or add to the equipment only one time as necessary to correct the defects with the supplier's cost.

c) The supplier shall provide qualified field personnel for the field service (ie., installation & commissioning etc.). The contractor shall provide field assistants, labors and arrange accommodation if necessary. All other expenses such as airfare, local transference, food, housing, etc. will be borne by the supplier.

d) If the supplier fails to deliver the CT and spare parts within the delivery or perform the services within the time specified in the purchaser's written advance notice, the supplier shall pay to the purchaser liquidated damages on the basis of 0.1% of each unit contract price of the delayed portion for each day's delay in the nature of a penalty to compel performance. However, the total amount of liquidated damages shall not exceed 5% of total contract price.

8 DOCUMENTATION

a) General Arrangement drawing of complete cooling tower (showing plan, front elevation and side elevation) incorporating principal dimensions, limits of scope of supply of piping, limits of civil works included, showing extent of platforms, walk ways, handrails, access doors staircase, end wall derrick etc. and the limits of scope of supply of electrical works and instrumentation.

b) General Arrangement drawing of cooling tower basin indicating overflow and desludging arrangement.

c) General Arrangement and Sectional Assembly drawings pertaining to the following components of the Cooling Tower:

   i. Tower fill with supporting arrangement.
   ii. Drift eliminator installation and details.
   iii. Complete hot water distribution system including flow regulating valves, distribution basin/ pipes and nozzles etc.
   iv. Fan and motor installation and coupling details.
   v. Cooling tower drawings showing all dimensions and cut views.

d) Arrangement drawing of the cold water outlet chambers and sludge pits incorporating also the arrangement of screens, gates, valves and piping terminal details.

e) Cooling tower performance curves showing wet bulb temperature V/s. cold water temperature for design cooling range, 90% cooling range and 110% cooling range at 90%,100% and 110% of design flow.

f) General Arrangement and cross-sectional assembly drawings of sludge pumps and motor drives along with their performance curves.

g) Electrical drawings and data:

   i. Cable Schedule

b) Hydrostatic test for piping & valves.
c) Field performance test of individual items and the cooling tower as a whole.
d) Any subassembly or assembly which fails to meet the acceptance criteria for any test or inspection shall be carried out as per section 4 of this document, and shall be reworked or replaced and retested. Non-conformance shall be disposed and documented according to the quality assurance program.
e) Inspection and test shall be performed by the personal qualified according to the quality assurance program.
f) The Purchaser shall have access to the Supplier's shop during fabrication and testing.
g) The Supplier shall submit Integrated Manufacturing and Quality Plan (IMQP) to the Purchaser for review and approval. Submittal shall be made as required by the contract but at least six weeks prior to release for fabrication.
h) The Supplier shall notify the Purchaser of hold/witness point inspection or test schedule in writing 30 working days prior to the anticipated schedule.
i) Inspection and test results shall be documented and reported to the Purchaser as required by this specification.
j) All personnel performing nondestructive examinations (RT/PT) to meet the requirements of this specification shall be qualified and certified (RT of 15% SS welds with images).
k) The Purchaser shall have the right to conduct (at its own expense) any additional examination or testing deemed necessary.

10 SPARE PARTS DETAILS

The spare parts to be provided includes but is not limited to the following

a) Fill of one cell.
b) One set of blades.
c) Drift eliminator for one cell.
d) Distribution nozzles of one cell.
e) 20% hardware.
f) Spare parts of speed reducer system.
g) Any other recommended by supplier.

11 PREPARATION FOR SHIPMENT

11.1 GENERAL

The cooling towers shall be prepared for shipment in accordance with API 610 and ASTM A700 or equivalent and the followings:

a) The interior of the cooling tower shall be clean and dry.
b) All machined surfaces shall be protected against mechanical damage.

k) The supplier shall be responsible for repair and re-supply of the CT assembly if deficiencies and damage are found.

l) Prior to packaging of each CT assembly, the unit shall be weighed and the weight recorded. The weight shall be in accordance with the CT assembly/outline drawings.

11.2 NAMEPLATE

Each cooling tower unit shall have a nameplate which includes the manufacturer's name, cooling tower serial number, year of manufacture, design capacity, design pressure and temperature and motor data.

11.3 INSTALLATION AND SERVICE REQUIREMENTS

The equipment shall be designed for normal installation; however, if special installation procedures or handling fixtures are necessary the supplier shall supply these far enough in advance to allow the user to prepare for installation of the equipment.

a) The design and construction of the CT shall be appropriate for long life and trouble free service.

b) All CT parts and accessories (except polymeric parts) shall be suitable for a sixty (60) year life.

c) Polymeric parts and other consumables shall be selected on the basis that they are required to perform their function for at least five (5) years at the service and environmental conditions according to the relevant Data Sheets.

d) The Supplier shall provide bills of material, maintenance plan and the recommended replacement interval for all consumable components in design file.

e) CT and its accessories shall be suitable for the service conditions indicated on the Data Sheets.

f) The design, materials, fabrication, inspection, testing and certification of the CT and its accessories shall be in accordance with the requirements of the Codes mentioned in this specification and the additional requirements of this specification (if provided). It is mandatory for the Supplier to possess a "Certification of Authorization" from ASME/ANSI or the appropriate Regulatory Authority.

g) Seismic data for 'Seismic Qualification' shall be completed by the Supplier for CT and it accessories that calls for seismic qualification.

11.4 RECEIVING INSPECTION

The purchaser shall perform the receiving inspection at site which includes the inspection for the products and the review of the documents.

The supplier shall pack the products to disassemble the packing and repack. The supplier shall provide the instruction for disassemble and repack.

APPENDIX-A

TECHNICAL SPECIFICATIONS OF COOLING TOWER

Ref No.	Name of Equipment		Project	Code No.	Room No.	Level (m)
	Cooling System Cooling Towers (SCS-CT 001, 002)			CT-01~02		±0.00
1	**General Requirements**		35	**Fill**		
2	Seismic category	-	36	Type:	Film fill/ Equivalent	
3	Q.A category	QA2	37	Material:	Polypropylene/ UV stabilized PVC/ Equivalent	
4	In-service inspection	Yes	38	Support material	Stainless Steel	
5	Number of CT	2	39	**Drift Eliminators**		
6	**Operating Conditions**		40	Type/ No. of passes	By vendor	
7	CT type: Mechanical induced draft cross flow film fill		41	Material	UV stabilized PVC/ Equivalent	
8	Fluid type	Soft Water	42	Support	Stainless Steel	
9	Flow rate m^3/hr per cell	300	43	Spacing/ thickness	By Vendor	
10	Design Heat Load Per cell	3MW	44	**Water Distribution**		
11	Operating Heat Load Per cell	2.5MW	45	No. of inlets	One per cell	
12	Operating pressure (MPa)	atm	46	Inlet pipe dia. / connections	By vendor	
13	Hot water inlet temp (°C)	41	47	Pipe & Support	By vendor	
14	Cold water outlet temp (°C)	32	48	Lateral distribution material	By vendor	
15	Wet Bulb Temperature (°C)	28	49	Nozzle type	By vendor	
16	Ambient dry bulb Max/Min (°C)	50/-1	50	**Fans**		
17	Range (°C)	9	51	Dia./ No. of blades	By Vendor	
18	Approach (°C)	4	52	Blades material	FRP/ Equivalent	
19	No. of independent cells per CT	2	53	Hub	Galvanized Steel	
20	No. of fans per cell	1	54	RPM/ Air flow/ Fan shaft power/ Fan stack type/ material	By vendor	
21	Drift losses: Minimum possible but <0.1% of circulation flow		55	**Fan Motor**		
22	Evaporation losses:	By Vendor	56	As Per Table 4-1 of Technical Specifications of Cooling Tower		
23	CT overall dimensions:	By Vendor	57			
24	Nominal cell size:	By Vendor	58			
25	**Design Requirements**		59			
26	Design Pressure MPa	0.65	60			
27	Design Temp °C	50	61			
28	**Structural materials**		62			
29	Item	Materials	63			
30	Cold water basin, outlet channel/ sump & sludge pit	Fibre-glass	64			
31	Structural frame work	Galvanized Steel	65			
32	Casing, Louvers, Partitions	Fiberglass	66			
33	Fan drive support	By Vendor	67			
34	Hardware (Anchors, bolts, nuts etc.)	Stainless Steel	68			

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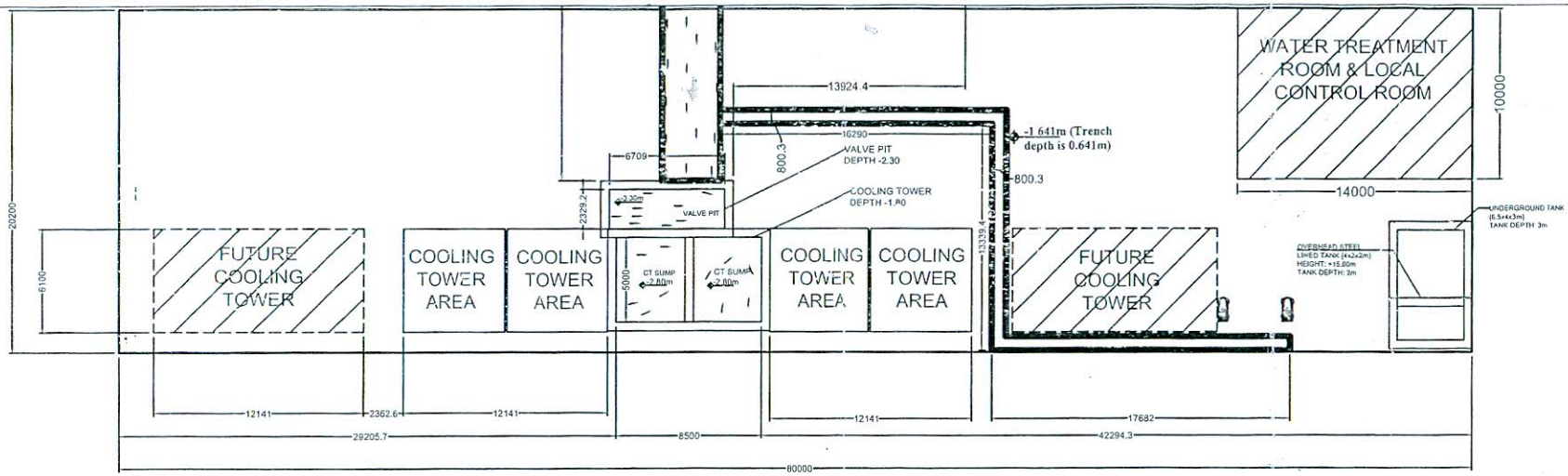

COOLING TOWER AREA LAYOUT (±0.00 FINISHED FLOOR LEVEL)

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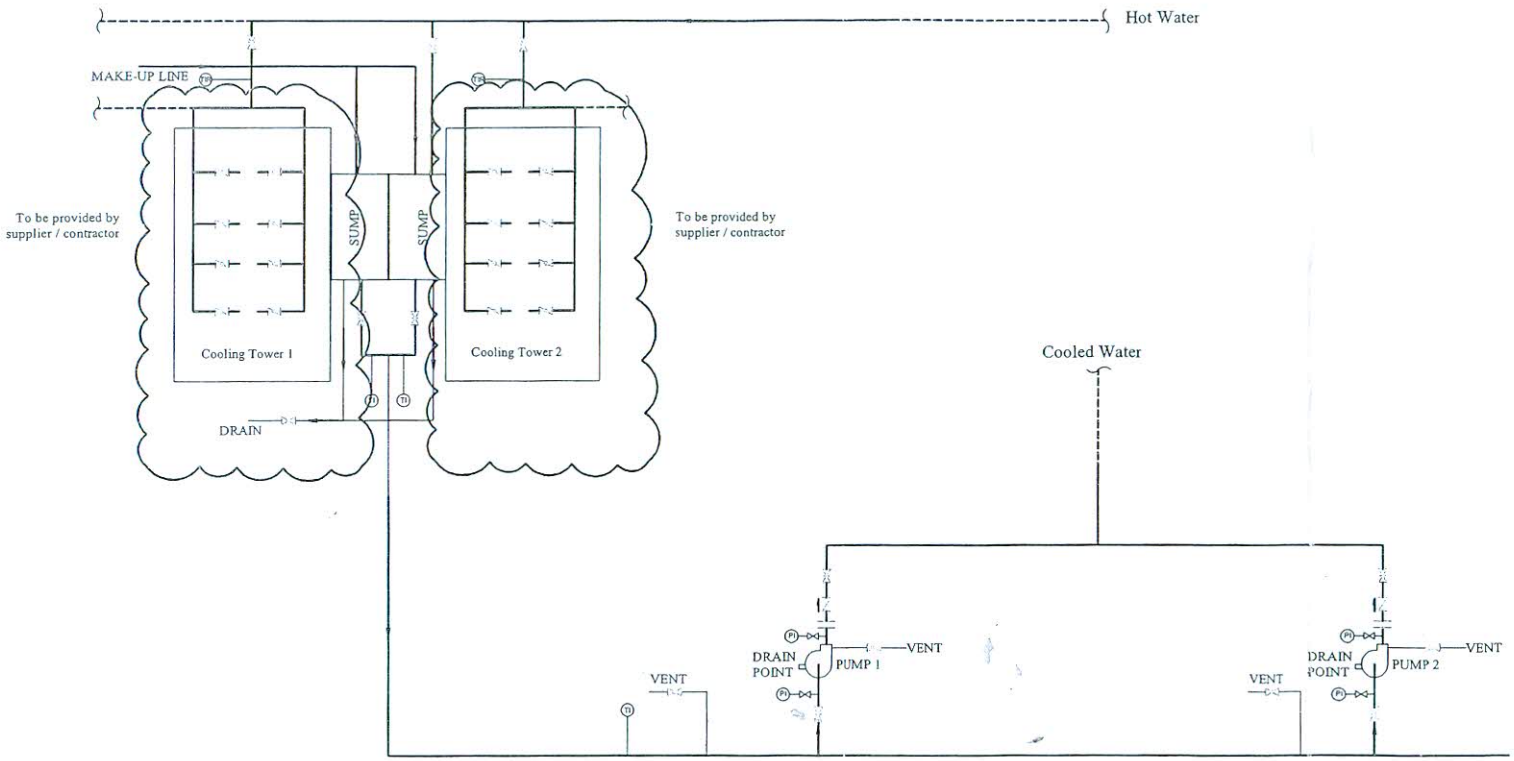

INSTRUMENT DESIGNATION					
VARIABLE	FIRST LETTER	SECOND LETTER			
		INDICATOR	ALARM	PRIMARY ELEMENT	RECORDER
TEMPERATURE	T	1	A	E	R
FLOW	F	—	A	E	—
CONDUCTIVITY	C	1	A	—	—
LIQUID LEVEL	L	1	A	—	—
PRESSURE	P	1	A	—	—
RADIATION	R	1	A	E	R

LEGEND	
SYMBOL	TITLE
	Gate Valve
	Check Valve
	Butterfly Valve

LEGEND	
Equipment Code	Description
HX	Heat Exchanger
PO	Pump
CT	Cooling Tower