TSGENCO
4X270 MW Manuguru TPS

VOLUME -IIB

TECHNICAL SPECIFICATION
FOR
COOLING TOWER

Specification No. : PE-TS-411-165-N001 (REV. 0)

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA - 201301

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 Volume -I CONDITIONS OF CONTRACT

This consists of four parts as below :

Volume - I A : This part contains instructions to bidders for making bids to BHEL.
Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.
Volume - I C : This part contains special conditions of contract.
Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 Volume - TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions
Volume - II B : Technical specification including drawings, if any

1.2.1 Volume - II B :

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.
Section - B : This section provides “Project Information”
Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.
Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C.
Data sheet-A specifies data and other requirements pertaining to the equipment.
Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)
Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 Volume - III TECHNICAL SCHEDULES

This volume contains technical schedules and Data Sheets – B (to be submitted at contract stage), which are to be duly filled by the bidder and the same shall be furnished with the technical bid.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.

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SECTION - A

SCOPE OF ENQUIRY

1.00.00 SCOPE

1.01.01 This enquiry covers the complete cooling towers including design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing, delivery at site, transportation, unloading/handling at site, erection, site painting, commissioning, testing of Natural draft cooling tower (NDCT) including electrical, C&I, civil & structural works, as specified & as necessary for completeness in all respects and for efficient & trouble free operation for 4x270 MW Manuguru TPS

The Structural and reinforced Steels for CT and Cement are excluded from Bidder's scope, they shall be free issue by BHEL. Terms and conditions for free issue items being given along with NIT.

However for Bid evaluation of the Cooling Tower, Bidder's total price shall be determined after adding cost of Steel & Cement as per rates specified else where in Bidder's total quoted price for the CT.

2.00.00 GENERAL TECHNICAL INSTRUCTIONS

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/Owner, who will interpret the meaning of drawing and specifications and shall be entitled to reject any component, work or material, which in his opinion is not in conformity with the duty requirements.

2.02.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipments shall not relieve the bidder of the responsibility of providing such facilities to complete the supply/ erection / commissioning etc. of cooling tower and its drives at quoted prices.

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

2.04.00 The equipments covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issued by BHEL.

2.05.00 In case of any deviation from this technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

2.06.00 Un priced copy of the price bid shall be furnished along with the technical bid.

SECTION – B

PROJECT INFORMATION
(Refer NIT)

SECTION - C

SPECIFIC TECHNICAL REQUIREMENTS

SECTION C1 - Specific Technical Requirements (Mech.)
SECTION C2 - Specific Technical Requirements (Electrical)
SECTION C3 - Specific Technical Requirements (Civil)

SECTION – C1

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.00.00 INTENT OF SPECIFICATION:

1.01.00 This specification is intended to cover the design, manufacture, inspection/ testing at manufacturer's works, delivery at site properly packed for transportation, unloading/ handling and storage at site, erection including civil works/ testing/ commissioning at site and performance testing of Natural draft type cooling tower for 4 **X 270 MW Manuguru TPP** including complete Electrical, C&I and Civil Works as specified and as necessary.

The Structural and reinforced Steels for CT and Cement are excluded from Bidder's scope, they shall be free issue by BHEL. Terms and conditions for free issue items being given along with NIT.

However for Bid evaluation of the Cooling Tower, Bidder's total price shall be determined after adding cost of Steel & Cement as per rates specified else where in Bidder's total quoted price for the CT.

The Natural draft type Cooling Tower covered under this specification is as under.

4 X 270 MW Manuguru TPP - 4 (Four) Nos. Cooling Tower

The performance parameters and other particulars of Cooling Tower are detailed in Data Sheet-A.

2.00.00 SCOPE OF EQUIPMENTS & WORKS UNDER THIS SPECIFICATION:

The equipment and works to be provided under this specification shall be as detailed below and as indicated in relevant portion of enclosed documents.

The items not specifically mentioned but deemed necessary to make the cooling tower complete in all respects, as self-contained package for reliable and efficient operation shall also be deemed to have been included in the scope of the bidder.

The scope of supply/ works including civil works as complete turnkey package includes complete civil works between the terminal points which are stated or unstated but required as per the system requirements except for items specifically mentioned in exclusion list of works. Scope of works includes preparation of design and drawings, obtaining necessary approvals, materials, execution as per codes, specification, best engineering practices and to the satisfaction of BHEL/ Owner for all mechanical, architectural, civil structural, building electrification, etc. BHEL will not bear any liability for any extra work, which might not have been perceived by the bidder but functionally required. The cost of such work will be entirely borne by the bidder.

Bidder shall visit and apprise himself fully with existing site conditions including soil condition, rainfall data, availability of all construction materials including backfill, graded material etc. and other aspects for construction of plant, building structures etc. No extra claim whatsoever on any account shall be entertained by BHEL.

The bidder shall furnish list of items/ services not included in his scope, otherwise the complete package shall be deemed to be in bidder's scope & Purchaser's interpretation in this regard shall be final & binding on the bidder.

The brief scope of supply, services & works for Cooling Tower, complete with hot water distribution system, cold water basin and outlet channels, sludge pit, stair case from ground level to water distribution level & Top of CT and all other equipments and accessories as mentioned herein after. It is not the intent to list all details herein; scope of supply listed is in brief.

2.01.00 Each Cooling Tower shall be complete with following:

2.01.01 Scope (Mechanical):

a) Incoming hot water piping, including vertical run, supported on cooling tower, Motorized Butterfly valves on hot water risers. Terminal point for hot water pipe shall be as marked in the tender drawing enclosed at **Annexure 1 & 2)** to Data Sheet - A. Welding at terminal point shall be in bidder's scope. Bidder shall also supply a Pressure Gauge & Temperature Gauge at the terminal point. Any reducer/ expander required at the terminal point shall also be in the bidder's scope.

b) Inlet louvers, tower fills & fill supports, drifts eliminators, including all supporting structures, fastening arrangements & accessories.

c) Screens, along with guides embedded in concrete shall be provided at the outlet of cold water channel.

d) Stop log gates and guides embedded in concrete at the outlet of cold water channel.

Manual chain pulley hoist, complete with chains and hooks, for lifting of the screens & gates.

e) Valves in sludge pits complete with extension spindle & pedestal type manual operator. The pipe spools shall be embedded in the wall through which extension spindle will be protruding.

f) Pipe spools to be embedded in sludge pit walls and terminated with flanged end at suitable distance from outer face of respective wall.

g) Water Distribution system consisting of troughs/ Pipes. Hangers & pipe supports & anchoring arrangement for all piping coming under the scope of supply.

h) Two (2) Nos. (1+1) sludge pumps (submersible type) complete with electric motors, non-return valve, isolation valve, piping supports, hangers etc. for cold-water basin drainage. The bidder shall terminate pump discharge pipe work at a distance of 100 M from sludge pit.

i) Counter flanges, bolts, nuts & gaskets for all piping connections in the scope of bidders and also at terminals.

2.01.02 Scope (Electrical):

a) Complete electrical equipments as per specification/ details indicated in Section C2 & D2 shall be in bidders' scope.

b) The scope of power & control cables & special cables shall be as per Annexure-1 of section C-2 (electrical).

c) Base plate, foundation plates, anchor bolts, sleeves, inserts in concrete work for electrical and mechanical equipments & accessories.

2.01.03 Scope (C & I):

a) Removable type Pitot Tube at each hot water inlet- piping header to measure the flow (during performance Guarantee test only). The Pitot Tube shall be left with customer after the completion of the test .

b) One no. Pressure Gauge and One no. Temp Gauge at Hot Water pipe header at T.P.

c) One no. of Anemometer for measurement of wind velocity.

d) One no. of Psychrometer.

2.01.04 Scope (Civil):

a) Complete civil works as detailed in Section – C3 including excavation, shoring, dewatering, backfilling, concrete work including shuttering, sand filling, disposal of surplus soil outside plant boundary, formwork including automatic climb form, laser beam survey instruments, fabrication, galvanizing and erection of steel structures and inserts, finishing anchor bolts, RCC sump/duct, laying and testing of hot water pipe line, water proofing, providing PVC water stops and joint fillers, drainage and other ancillary items connected with cooling towers. All faces of concrete structures and steel structures coming directly in contact with water shall be coated with corrosion resistant coating system as approved. The surfaces that would include are inner face of hyperbolic shell, raker column faces, inner faces of cold water basin, fill support structures, hot water distribution ducts & channels, cold water channel etc.
The scope of this work shall consist of , but not limited to, the design and construction of reinforced concrete double curvature hyperbolic shell, ring beams, foundations (including Piling, if required), cold water basins with partition walls, hot water ducts, drain sumps, external drain chamber with associated pipe work, cold water channels with stop log gate up to the terminal point as specified elsewhere, hoists and monorails, primary and secondary hot water distribution troughs, fill support system including columns and beams, drift eliminators, testing of cold water basin for water tightness, external stairs, sludge pit for each basin section, all other staircases/ladders as required, doors and their frames, walkways, platforms, steel fitting, fixture, inserts, including fabrication, hand railing, providing protective measures in concrete and steel materials against effect of water and other chemicals on the completed structure etc.

b) Supply & application of painting at site.

2.01.05 The following are also included in bidder's scope:

a) One set of special tools & tackles required for maintenance of equipments & accessories in the cooling towers.

b) Various drawings, datasheets, calculations, test reports/ certificates, operation & maintenance manuals including "As built drawings" etc. as specified & as necessary.

c) Supply of first fill of lubricants for all equipments under this package including second fill/ replenishments as necessary during & after commissioning till handing over of the plant.

d) Supply of commissioning spares on as required basis.

e) Scope of services shall include but not limited to erection/ testing/ commissioning/ trial run/ performance testing & handing over of cooling towers. Transportation of equipments, material to site, local clearance, storage at site etc. & supply of all labor including supervision personnel, materials, erection tools & tackles etc. as necessary for expeditious execution of works etc. are also included in bidder's scope. It shall be the responsibility of the bidder to arrange all T & P required for the execution of complete job including erection & civil works.

3.00.00 Equipment & Services to be provided by Purchaser:

a. Supply and erection of incoming hot water piping up to bidder's terminal point.

b. Supply & erection of sludge discharge piping beyond the bidder's terminal point, if applicable.

c. Cold-water outlet channels for cooling tower beyond the bidder's terminal point.

d. For Electrical and Civil works refer Sections C2/ D2 & C3 respectively enclosed herein.

4.00.00 The cooling tower shall comply with standard technical specifications of cooling towers enclosed in section -'D' & data sheet- A. In the event of any conflict between Section -'D' / data sheet-A' &

section 'C', the latter shall prevail. Customer specification for cooling tower is enclosed at Annexure 'A' and it shall prevail in the event of conflict.

5.00.00 **Thermal Design of Cooling Towers:**
The thermal design of cooling towers shall fulfill following design criteria.

5.01.00 Sensible heat of evaporated water shall be taken into account for calculating the air flow requirement, as per the following equation.

$$G*H = L (T_1-T_2)+(E*V*T_2)$$

Where

L	=	Water flow rate in Kg/hr.
T_1	=	Water inlet temperature to the tower in Deg.C
T_2	=	Water outlet temperature to the tower in Deg.C
EV	=	Evaporation loss in Kg/hr. at RH (as specified in Data Sheet-A)
G	=	Air flow rate in Kg/hr.
H	=	Change in enthalpy of air in Kcal/kg.

5.02.00 For the specified design conditions of water rate, range, approach, wet bulb and dry bulb temperatures Bidder shall calculate and furnish the duty coefficient "D". A nomogram indicating the ratio of water rate and duty coefficient, recooled water temperature and other thermal conditions specified shall be furnished with the bid. The nomogram shall cover the entire operating range and shall extend up to a wet bulb temperature of as specified in Data Sheet-A.

Along with the thermal design calculations as specified above, bidder has to submit the calculations for:

- Total height of Natural Draft Cooling Tower
- Basin sizing
- Height of the hot water distribution header
- Drift Eliminator sizing
- Inlet Louver Sizing
- Sludge pit sizing

5.03.00 Based on the duty co-efficient and performance characteristics of the fill the bidder shall furnish an equation expressing the relationship between the plan area of packing and the square root of tower height.

5.04.00 Bidder shall furnish performance characteristic curves for following variations in design parameters.15%, 25%, 60%, 70%, 80%, 90%, 100%.

Bidder shall also clearly identify various "Guaranteed Zones" as per the requirement of code.

5.05.00 Bidder may note the calculations specified above must be enclosed with the offer without which bids run the risk of rejection. In case these calculations are based on the collaborator's design then these calculations should be duly vetted by his collaborator. The bidder shall show, explain and prove the validity of the basis, procedures and methods used in these calculations.

5.06.00 The tower configuration shall be such that it shall offer minimum restriction to air flow.

5.07.00 The Cooling Tower Thermal design calculations shall be got vetted and approved by bidder from any of the IIT's (Indian Institutes of Technology) in the event of order along with the related CT drawings for fill arrangements etc. and charges for same shall be included in the bidder's base price itself.

The Purchaser/ Customer however also reserve the rights to check the detailed calculations in the event of order and their interpretation shall be final in the event of any conflict.

5.08.00 The total CW Pumping head (MWC) within bidder's terminal points shall not exceed the respective maximum limits specified in Data Sheets A.

The CW pumping head specified limit is inclusive of static head plus frictional losses including 10% margin on frictional losses.

No technical advantage shall be given to any bidder for total CW pumping head (MWC) offered less than above maximum limits.

In the event of total CW pump head (MWC) offered being more than above maximum limits, the bids will be summarily rejected.

The bidder's Cooling Tower thermal design shall take care of above aspects including maximum permissible plan dimensions indicated in Data Sheet A.

6.00.00 Specific Requirements

In addition to the salient technical requirements stipulated in Section "D", the bidder may note specific requirements detailed herein for design of the cooling towers.

6.01.00 No wood/ timberwork shall be used in any component of the cooling tower.

6.02.00 The quality of water in CW sump shall be clarified water with analysis as given in data sheet-A of Section. D.

a) The COC in CW System shall be '**5'**.
b) Control of biological / algae is envisaged in purchaser's scope.

6.03.00 The location, orientation, wind rose, scope demarcation, water levels etc. for the cooling tower shall be as per the sketch enclosed at Annexure – 1 & 2.

6.04.00 Fills shall be PVC Splash V bars Type in easily removable sections.

6.05.00 PVC Drift eliminator blades shall be of three-pass full wave type supported on concrete framework & shall limit the drift losses to a value not greater than 0.005 % of the design water circulation rate.

6.06.00 All parts subjected to periodical maintenance & inspection such as Inlet louvers (if applicable), fills, drift eliminators etc. shall be readily accessible.

6.07.00 Access doors shall be provided for entry into cooling water distribution level. The doors shall have easily operable shutter of leak proof design & shall be of MS construction with 2 coats of red oxide zinc chromate primer

6.08.00 Two R.C.C. staircase for approach to hot water distribution level & aviation warning lamp etc.

6.09.00 Four external cage ladders for approach to top of cooling tower from ground level.

6.10.00 Access platforms and walkways with handrails for inspection and maintenance of hot water distribution system and Aviation Warning Lamp etc.

6.11.00 All steel parts in direct contact with water or humid air shall be of SS 304. All other steel parts not in direct contact with water/ humid air shall be galvanized steel. No hardware shall be of Cu or Cu based alloys. Material of construction shall be as indicated in Datasheet "A". Wherever the material of construction for any component is not given, same shall be suitable for the intended service & shall be subject to purchaser's approval during detailed engineering stage in the event of order.

6.12 00 The sizing of the hot water distribution system shall be done by limiting the velocity through the pipes to a maximum of 2.0 m/sec.

6.13.00 a) Piping for sizes above 150 Nb Carbon steel plates to IS 2062, rolled and welded as per IS 3589.
c) Piping up to and including 150 Nb shall be IS 1239 (Heavy Grade).

Required wall thickness for Hot Water riser and Distribution piping shall be as follows:

NB	OD	THK
1400	1422.00	14.0
1800	1829.00	16.0
2500	2540.00	20.0

6.14.00 The buried piping in bidders scope shall be steel pipe. Welding of pipe header with Purchaser's pipe at terminal point shall be in bidder's scope. The thrust block etc. shall also be in bidder's scope.

Provision of at least 2 nos. welding sockets at water distribution level shall also be in bidders scope.

6.15.00 Motor Operated B.F. valves shall be provided in hot water distribution riser.

6.16.00 The cold-water basin of cooling tower shall be provided with a partition wall to facilitate isolation of each half of CW basin whenever required through isolating gates viz. minimum two nos. gates shall be provided for each cooling tower. CT basin shall be provided with adequate slope (Min slope of 1:150) towards the sludge sump for drainage purpose.

6.17.00 Under each valve, flange joint & such other items prone to gland/ joint leakage, suitable trays/ channels shall be provided so that any leakage water does not spread on the surroundings. This is also applicable for any air release valve that has to be mounted on hot water riser top. Erection of such air release valves has also to be done by the bidder.

6.18.00 Bidder to note that all sub vendors shall be subject to BHEL/ Customer approval in the event of order.

7.00.00 Deleted

8.00.00 PERFORMANCE TESTING AT SITE

8.01.00 Scope:

To ascertain the fulfillment of guarantees after completion of erection and commissioning of the cooling tower, contractor shall carry out performance test at site of one no. CT in presence of employer / purchaser through **CTI approved testing agency**. Under no circumstances, the bidder himself will conduct the test even if approved by CTI. The testing agency shall be independent from the bidder.

The balance three (3) Cooling Towers shall be tested by bidder himself in presence of Employer/Purchaser.

8.02.00 Codes:

The following codes and standards shall be applicable for conducting test unless otherwise modified or supplemented by the enclosed procedure and mutually agreed to between Owner, BHEL and bidder.

a) Code ATC-105: Acceptance test code for water cooling towers. (latest Version).
b) BS-4485: Specification for Water Cooling Tower.
c) BS-1042: Methods for the measurement of fluid flow in pipes.
d) BS-3435: Measurement of electrical power and energy in acceptance testing.

e) ASME 19.5: Supplements on instruments and apparatus.

8.03.00 Conductance of tests:

Performance testing of cooling tower shall be done to demonstrate the guaranteed cooling water temperature at rated duty point. The cold-water temperature as specified in the specification shall be guaranteed by the bidder for the design conditions of CW flow, range, ambient WBT as specified

8.03.01 The bidder shall submit cooling tower performance test procedure as per ATC 105 in consultation with CTI approved testing agency for approval & conduct the test as per the approved procedure, in the event of order.

8.03.02 The bidder shall be given permission to inspect the Cooling Tower in advance and ready it for the test.

8.03.03 One Cooling Tower performance shall be tested jointly by CTI approved testing agency in presence of the bidder, BHEL and Owner. All the representatives shall jointly record data of test.

i. The responsibility for conducting the test will be with the bidder.

ii. **All test instruments required for the PG test will be provided by CTI approved testing agency / or the instruments provided by contractor if the same meets the stipulations of the CTI testing agency and acceptable to testing agency.**

iii Calibration of instruments to be used in the test shall be carried out by an approved independent agency. Calibration of instruments should be carried out previous to, but not more than six months before the test. The calibration certificate of the instruments should be valid for the period of test.

iv List of instruments to be arranged by the bidder along with the calibration certificates of the instruments to be used and psychometric charts and tables should be submitted to **CTI/** owner for approval.

8.03.04 PG test shall be carried out by the bidder after completion of trial operation of the cooling tower and at a time when the atmospheric conditions are within limits of deviation from the design conditions as specified in this section preferably in the period from May to September.

8.03.05 Performance test shall be carried out based on ambient WBT. The performance curves of the towers showing variation in performance with change in ambient wet bulb temperature, cooling range, relative humidity water loading of the tower etc, required to ascertain the performance of the tower shall be furnished along with the bid. Performance curves applicable to 90%, 100% and 110% of the design water flow rate shall be furnished. Each set shall consist of three or more cooling range curves and at least four relative humidity curves, arranged to show the effects of wet bulb temperature, relative humidity and cooling range on outlet water temperature. The range curves shall be presented in uniform increments of 0.5 deg. C, with sufficient scope to cover approximately $\pm$ 20% of design range. The relative humidity curves shall be presented for spaced increments to cover the extent of expected conditions such as 5%, 20%, 40%, 60% and 100% relative humidity. The design conditions shall be indicated on the set applicable to design water flow rate. The dry bulb temperature associated with the wet bulb on each fixed relative humidity graph shall be included. The curves shall fully cover (but not necessarily be limited to) the range of variations specified. All performance curves shall be based on ambient wet bulb temperature.

8.03.06 The guaranteed performance of the equipments shall be demonstrated by the bidder after evaluating the P.G. test should the result of the test deviate from the guaranteed values the bidder shall be given an opportunity to modify the equipment as required to enable it to meet the guarantees. In such cases the PG test shall be repeated within one month from the date on which the equipment is ready for retest and cost of modification, including labour, materials and cost of additional testing shall be borne by the Bidder. The chance for repeat testing will be given only once during the contract period . All the modifications carried out by the bidder in the Cooling Tower to

meet the contractual requirements shall be carried out free of cost to the Owner in other towers (if applicable for the package).

8.031.07 In case the test cold water temperature as determined from the PG test is higher than the predicated value (based on the performance curves). Owner reserves the right to reject/ accept the tower after assessing the liquidated damages as specified.

9.00.00 The makes of all the equipments under this specification shall be subject to purchaser's approval in the event of order.

10.00.00 It is mandatory for the bidder's to furnish along with the bid the deviations if any, whether major or minor in the '**Schedule of Deviations**' only. In the absence of the deviations listed in the '**Schedule of Deviations**', the offer shall be deemed to be in full conformity with the specification not withstanding anything else stated elsewhere in the offer, data sheets etc. **The hidden deviations or stated/ implied deviations in the offer shall not be acceptable and binding on the purchaser**.

11.00.00 PERFORMANCE GUARANTEES AND LIQUIDATED DAMAGES

a) Performance testing of cooling tower shall be done to demonstrate the guaranteed cooling water temperature at rated duty point. The cold-water temperature as specified in the specification shall be guaranteed by bidder for the design conditions of CW flow, range, ambient WBT as specified.

In case the test cold-water temperature as determined from the PG test is higher than the predicted value (based on the performance curves). Owner reserves the right to reject the tower. In the event of its acceptance by purchaser liquidated damages as follows shall be applicable.

0.1°C over the guaranteed value	=	125 lacs
0.2°C over the guaranteed value	=	250 lacs
0.3°C over the guaranteed value	=	375 lacs
0.4°C over the guaranteed value	=	500 lacs
0.5°C over the guaranteed value	=	625 lacs
0.6°C over the guaranteed value	=	750 lacs
0.7°C over the guaranteed value	=	875 lacs
0.8°C over the guaranteed value	=	1000 lacs
0.9°C over the guaranteed value	=	1125 lacs
1.0°C over the guaranteed value	=	1250 lacs

Bidder to note that the liquidated damages (as specified) for shortfall in performance shall be worked out independently for each cooling tower. To ascertain the fulfillment of guarantees of the cooling towers, the test results of the tower tested through CTI approved testing agency shall be considered for PG test evaluation and based on the test result, the liquidated damage if applicable shall be levied.

b) The bidder shall guarantee the following, apart from other performance guarantees of the complete package.

- Total CW pumping head within the bidder's terminal points viz. static head & frictional losses for cooling tower.

c) The static head for calculating CW pumping head shall be considered up to top of the top most pipe without any siphon recovery.

Frictional losses for pipes shall be as per William & Hazen formula with C = 100. Frictional losses for various valves & fittings e.g. Miter bends, valves, tees, reducers etc. shall be as per crane handbook. Ft Value for fitting friction drop calculation to be considered as 0.012 for all

sizes greater than 600NB. The frictional losses shall be computed considering 10% margin on same.

William & Hazen formula: $V = 0.85 \times C \times (i)^{0.54} \times (d/4)^{0.63}$.

The bidder shall substantiate the CW pumping head with calculations in the event of order and same shall be subject to approval.

c) The successful bidder shall demonstrate the above guarantees during performance testing at site.

The purchaser is, however, not bound to accept the equipment and reserves the right to out rightly reject it if the actual values exceed beyond the plant design limits.

12.00.00 INSPECTION AND TESTING:

Purchaser/ Customer or their authorized representatives shall have the right to inspect at any stage of manufacture & construction, all materials, components & workmanship & testing of material. The bidder shall provide all facilities for inspection & testing without any extra cost to the purchaser/ Consultant.

12.01.00 The contractor/ manufacturer shall conduct the following minimum specific tests to ensure that the equipment shall conform to the requirements of this section and in full compliance with the requirements spelt out in applicable codes and standards.

12.02.00 Material identification and testing of regulating valve assemblies, screen assemblies, all supporting structural assemblies, fills, all nuts and bolts, sluice valves, nozzles and all other applicable components constituting each cooling tower.

12.03.00 Hydrostatic testing of hot water distribution piping regulating valves and all other pressure parts at a pressure and duration as spelt out in this specification.

12.04.00 Visual, dimensional checking of all components of each cooling tower.

12.05.00 Material testing of all components, hydrostatic testing of all pressure parts at a pressure and duration in compliance with this specification, static and dynamic balancing tests of all rotating components such as pump shaft, line shaft, impeller etc. and complete performance testing as minimum for each sludge pump in each cooling tower.

12.06.00 Tests for hoists, chain pulley blocks and all other lifting tackle shall be carried out as per relevant Indian/ equivalent international standards.

12.07.00 Any other tests deemed necessary for safe, reliable and satisfactory operation of the equipment.

13.00.00 QUALITY PLAN:

13.01.00 The inspection & testing of the cooling towers & its various components shall be as per quality plans approved by the purchaser/ Customer. Bidder shall submit the quality plans based on the guidelines given in specification & quality plans enclosed herein. The customer hold points of BHEL/ Customer/Customer nominated agency shall be marked in the QP at the contract stage, in the event of order & inspection/ testing shall be carried out as per same apart from various test certificates/ inspection records etc.

Following standard QP are enclosed for bidder's guidance:

- Cooling tower
- Pipes, fittings & pipe work
- BF Valves
- Chain Pulley Blocks
- Gate/ Globe Valves

- Submersible Pumps

13.02.00 The quality plans for various electrical, C&I and Civil works are enclosed in respective sections for bidder's compliance.

13.03.00 For equipments not covered above, bidder shall submit QP's for same on the basis of similar guidelines & submit for approval in the event of order.

14.00.00 Tests at Site:

14.01.00 After completion of erection and commissioning of the cooling tower, supplier in accordance with cooling tower Institute Bulletin No ATC-105 "Acceptance Test Procedure for Industrial Cooling Tower" shall carry out performance tests of each cooling tower.

14.02.00 Necessary correction curves shall be furnished by the supplier for approval along with the proposed test procedure for correcting the test results for any difference between test and guarantee design conditions.

14.03.00 All mounting and calibrating instruments required for site performance tests shall be arranged by the cooling tower supplier without any extra cost.

15.00.00 DRAWINGS, CURVES AND INFORMATION REQUIRED:

15.01.00 The following documents only shall be furnished by the bidder with his offer:

a) Compliance certificate duly signed and stamped (enclosed herein).
b) General arrangement drawing for cooling tower, incorporating all relevant dimensions, Fill layout, water distribution layout, cold water channels / sludge chamber/ screens/ gates in the cold water channel, staircase etc.
c) Pumping head calculations.
d) Thermal design calculations (NDCT diameter & height calculation).

Note: The GA drawing/ calculations shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract). However diameter and height of CT during contract stage shall not be less than the proposed dimensions as offered in the bid.

e) Tower performance curves.
f) Guarantee Schedule duly signed and stamped (enclosed herein)
g) Technical deviation schedule (if reqd.) (enclosed herein)

Apart from above no other drgs./docs./data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.

16.00.00 Successful bidder in the event of award of contract shall furnish the drawings/ documents as listed in Data Sheet-C. Distribution of various documents shall be as per the Annexure to Data Sheet-C:

TECHNICAL SPECIFICATION

FOR

NATURAL DRAFT COOLING TOWER

(ELECTRICAL PORTION)

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Erection and Commissioning spares.
e) Erection & Maintenance tools & tackles.
f) Electrical load requirement for NATURAL DRAFT COOLING TOWER.
g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
j) Motor shall meet minimum requirement of motor specification.
k) LT power & control cables shall meet minimum requirement of LT power & control cables specification.
l) Cabling, earthing & lightning protection shall meet minimum requirement of cabling, earthing & lightning protection specification.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

a) A copy of this sheet "Electrical equipment Specification for NATURAL DRAFT COOLING TOWER" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor.
b) Technical datasheets & quality plans for LT motors.
c) Technical datasheets & quality plans for cabling, earthing & lightning protection.
d) Technical datasheets & quality plans for lighting system.
e) Electrical Load data format.