TECHNICAL SPECIFICATION FOR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEM

PROJECT	**1 X 100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE -1) –NAMRUP , ASSAM**
CUSTOMER	**ASSAM POWER GENERATION CORPOTATION LTD, GUWAHATI, ASSAM**
CONSULTANT	**M/S DEVELOPMENT CONSULTANTS (P) LTD CONSULTING ENGINEERS**

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1. INTENT OF SPECIFICATION:

1.1. This specification comprises the details of Balance Scope of Works for Air Conditioning System and Ventilation System for 1x 100 MW APGCL Namrup Project, to be carried out by contractor, but not limited to following for final painting, erection, testing, commissioning and performance testing, final handling over as mentioned hereinafter for the HVAC System , which form part of project.

2. SPECIAL NOTES TO BIDDERS

2.1 This specification shall be read in conjunction with all its enclosures.

2.2 Heating Ventilation and Air conditioning system (HVAC system): This is a central air conditioning system of 85 TR capacity, supplied and erected partially by other contractor. There are several leftover erection works w.r.t. overall completion of the system. Detailed balance works have been described in the “scope of work” clause in this specification. The original equipment manufacturer of chiller is M/s Voltas.

2.3 Pressurised Ventilation system and exhaust fans: This is a pressurised ventilation system of 85,000 cmh capacity, supplied and erected partially by other contractor. There are several leftover erection works w.r.t. overall completion of the system. Detailed balance works have been described in the “scope of work” clause in this specification. The original equipment manufacturer of blowers and fans is M/s C.Doctor.

2.4 In this specification, enough clarity has been brought by BHEL regarding the site front facilities, nature and Quantum of Balance works of HVAC system and ventilation system, that must be completed to commission the systems. The site photographs are also enclosed for better understanding of the jobs.

2.5 It may be noted that the best efforts have been made to give full clarity of the scope to the bidder. Bidder is advised to visit the site and understand the scope of works before making a quotation against this specification. However no price implications shall be acceptable w.r.t. non-familiarity of works or additional works.

2.6 All mounting hardware/ accessories/fittings/conduits/erection consumables etc. required for the completion of the Air Conditioning and ventilation System package shall be included in the basic price quoted by the bidder. Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.

2.7 The Bidder shall at his cost perform any services, tests etc, although not specified but required for the completion of work.

2.8 During the course of execution of this work, certain rework/ modification/ rectification/ repairs / fabrication/dismantling/grouting etc. will be necessary because of feedback from customer for the work completed earlier. Contractor shall carryout such rework /

modification/rectification/fabrication/repairs etc., promptly and expeditiously without any additional expense.

2.9 All tools and tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables such as welding electrodes, welding receptacles etc. required for this scope of HVAC work shall be provided by the Contractor. All expenditure in this connection shall be included in the main package price. No separate price for the same shall be offered.

2.10 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment and the Air-conditioning plant and Ventilation system as a whole.

2.11 Bidder to quote strictly as per BHEL's price format. Failure to do shall make their offer liable for rejection. Any tampering/modification/change of the BHEL's price format is not allowed and such bidders are liable for rejection of bidders offer.

2.12 The entire work of Erection, Testing and Commissioning of Air Conditioning and Ventilation system works as detailed elsewhere in the Tender Specification shall be completed within two months from the date of issue of issue of LOI/Work Order or handing over of site whichever is earlier.

2.13 Bidder must adhere to the **"Special Conditions of Contract"** enclosed in Annexure-1 and quote accordingly.

3. PROJECT DESCRIPTION

Sl. No.	Project Details	
1.	Name of the Project	1 X 100MW Namrup Combined Cycle Replacement Power Project (Phase -1) –Namrup , Assam
2.	Customer	Assam Power Generation Corporation Ltd, Guwahati, Assam
3.	Project Consultant	M/s Development Consultants (P) Ltd Consulting Engineers
4.	Project Location	Namrup , Assam

4. SCOPE OF BALANCE AIR-CONDITIONING & VENTILATION WORKS

4.1 Heating, ventilation and air conditioning (HVAC) system:

a. Supply of following minor materials for HVAC system:

S. No.	Item Description	Unit	Quantity	Applicable Sub System / Equipment	Remarks
A.	**BALANCE SUPPLY OF MATERIALS DESCRIPTION**				
1	Anti-Vibration Pads for Chiller Installation: Rubber Pad Size : 150 x 150 x 12 mm	Nos	24	For Installation of Chillers (2 Nos) at foundation in AC Plant room; 12 nos. of Pads are envisaged for each chiller.	Chillers have been placed on foundation. Bidder to place the pads and complete the erection works.
2	Foundation Bolt for Chiller Installation: Foundation Bolt Size : M22x225L	Nos	12	For Installation of Chillers (2 Nos) at foundation in AC Plant room; 6 Nos. of foundation bolts are envisaged for each chiller.	Chillers have been placed on foundation. Bidder to fix foundation bolts and complete the erection works.
3	Foundation Bolt for Chilled and Cooling Water Pumps Foundation Bolt Size : M16x250L	Nos	24	For Installation of Chilled Water Pumps and Cooling Water Pumps at Pumps foundation in AC Plant room.	Bidder to fix foundation bolts to the equipment and complete balance erection of equipment.
4	Level Switch for Expansion Tank and FRP Cooling Towers	Nos	3	(a)1 No Level Switch for Make-Up Water Expansion Tank in AHU Room (b) 2 No Level Switch for Basin of FRP Cooling Tower at Roof of the Control Building	The level switch to be fixed to expansion tank and wire to the control panel and terminate.
5	PUF Insulation material with Aluminium cladding for Chilled Water Pipe PUF Insulation Density : 24Kg/cm3 ; Th: 50 mm)				

5A	PUF Insulation material with Aluminium cladding for Chilled Water Pipe PUF Insulation Density : 24Kg/cm3 ; Th: 50 mm)	Mtrs	140m (pipe length)	For Chilled Water Interconnecting Piping between : Chillers In/out to AHU In/out (100 NB Pipes)	Chilled water Pipes to be insulated with PUF insulation along with Aluminium cladding.
5B	PUF Insulation material with Aluminium cladding for Chilled Water Pipe PUF Insulation Density : 24Kg/cm3 ; Th: 50 mm)	Mtrs	35 (pipe length)	For Chilled Water Interconnecting Piping between : AHU Drain inside AHU room (40 NB Pipes)	Chilled water Pipes to be insulated with PUF insulation along with Aluminium cladding.
5C	PUF Insulation material with Aluminium cladding for Chilled Water Pipe PUF Insulation Density : 24Kg/cm3 ; Th: 50 mm)	Mtrs	25 (pipe length)	For Chilled Water Interconnecting Piping between : Chiller Drain in AC Plant room (32 NB Pipes)	Chilled water Pipes to be insulated with PUF insulation along with Aluminium cladding.
6	Cast Iron wafer type Butterfly Valves - 100 NB	Nos.	2	To be installed on Suction and Discharge Line of FRP Cooling Tower.	Valves are to be erected in respective pipelines.
7	Pressure Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)				
7.i	Pressure Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)	Nos.	4	For Suction and Discharge Line of : Chilled Water Pumps inside AC Plant room.	PGs with hook-up materials to be erected as per P&ID which is enclosed.
7.ii	Pressure Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)	Nos.	4	For Suction and Discharge Line of : Cooling of Pumps inside AC Plant room.	PGs with hook-up materials to be erected as per P&ID which is enclosed.
7.iii	Pressure Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)	Nos.	8	For Suction and Discharge Line of : Chiller for chilled water Line	PGs with hook-up materials to be erected as per P&ID which is enclosed.
7.iv	Pressure Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)	Nos.	6	For Suction and Discharge Line of : Condensor for cooling water Line	PGs with hook-up materials to be erected as per P&ID which is enclosed.

8	Temperature Gauges with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation)	Nos	10	For Suction and Discharge Cooling Water Line of FRP Cooling Towers at Roof of the Control Building	TGs with hook-up materials to be erected as per P&ID which is enclosed.

b. The erection works to be taken-up for HVAC system:

B	PENDING INSTALLATIONS DESCRIPTIONS	Unit	Qty.	Applicable Sub System / Equipment	Remarks
B.1	**Balance Air Distribution System:**				
i.	Balance Ducting works for Fabrication of duct; Fabrication of Duct portion for Plenum inside AHU room. Required GI sheet material is available. Bidder to fabricate the duct using this material. Necessary duct connection method is indicated in enclosed duct layout. Approx. size of duct is 3075mm x 1845 mm.	Sqmt	10	Fabrication of Plenum duct in AHU room.	GI sheet to fabricate duct is free issue to bidder. Duct Layout for AC system enclosed.
ii.	Balance Ducting works for Installation of duct; Already fabricated duct portion of approx. 60 sqmt are to be erected inside AHU room. Necessary anchor fasteners and hanging rod required for duct support / duct installation to be carried out	Sqmt	60	Erection of Plenum duct in AHU room. The duct shall be connected with AHU and supply air duct.	The 50 Sq.m of fabricated duct is available at site and free-issue to bidder. Balance 10 sq.m duct to be fabricated by bidder under sl. No. (i) above. Duct Layout for AC system enclosed.
iii.	Balance Acoustic Insulation for Ducts. Acoustic insulation work of approx. 10 sqmt to be carried out inside outlet of AHU. Accoustic insulation material is available at site. Bidder to use this material on duct. All the ancillary materials required for fixing insulation material on the duct shall be included by bidders.	Sqmt	10	Application of Acoustic Insulation for Plenum; Inside AHU room	Acoustic insulation is free-issue to bidder. Duct Layout for AC system enclosed.

iv.	Application of Thermal Insulation for Ducts of 60 Sq.m. inside AHU room. The thermal insulation material is available at site. Bidder to use this material. The materials, like cleats, adhesive, etc, required to fix/ apply thermal insulation on the duct shall be included in this work by bidder.	Sqmt	60	Thermal Insulation for Plenum and Branch duct inside AHU room	Thermal insulation material is free-issue to biddr. Duct Layout for AC system enclosed.
v.	Fixing of Supply and Return Air Diffusers in Air Ducting / false ceiling; Size: 350x350mm. Ductwork upto the neck/collar of the diffusers in control room is already completed. Air diffusers are also available at site. Diffusers fixing in false ceiling/ duct collar to be carried out by vendor.	Nos	120	Fixing of Supply Diffusers at outlet of Supply Air Ducts & Return Diffusers in False Ceiling/ Duct collar of control room	Air diffusers are free issue to bidder. The duct work is already in place. Duct Layout for AC system enclosed.
vi.	Installation of Motorised Fire Damper with Actuators in Duct Plenum. This Motorised Fire damper is be erected in duct plenum of the AHU as per the drawing. Fire dampers and cable are available at site. Bidder has to fix the fire dampers in the ducting and cables to be laid from fire dampers to AHU panel and fire alarm panel. Cable termination also to be carriedout by bidders.	Nos	2	Fire Dampers with actuator in Supply air duct and on return air path inside AHU room.	All Materials are available in stores. Duct Layout for AC system enclosed.
vii.	Fine Filters Installation in Air Ducting. Fine filter is to be erected in the plenum of the duct in AHU room. Fine filters are available at site. Bidder to erect these filters.	No	1	Fine filter in Supply Air Duct inside AHU room.	Fine filters are free issue to bidders. Duct Layout for AC system enclosed.
viii.	Duct Heater Installation in Duct.	No	1	Duct Heater in Supply Air Duct inside AHU	Duct heaters and cable are free issue

	Duct heater is envisaged in the plenum of the duct and the same is available at site. Bidder to erect the duct heater. Necessary control cabling from duct heater to thermostat, located in AHU room, to be carried out by vendor. Cable will be free-issue to bidder.			room.	to bidder. Duct Layout for AC system enclosed.
ix.	Humidistat Installation inside AHU Room. Fixing of Humidistats and necessary cabling and termination from humidistat to humidifier to be carried out be vendor. Humidistats and cables are available and free-issue to bidder.	Nos	2	Humidistat inside AHU room	Humidistats and cables are available and free-issue to bidder. Duct Layout for AC system enclosed.
x.	Thermostat installation in Air Ducting. Fixing of Thermostats and necessary cabling and termination from thermostats to duct heater to be carried out be vendor. Thermostats and cables available at site and free-issue to bidders	Nos	2	Thermostat inside AHU room	Thermostats and cables available at site and free-issue to bidders. Duct Layout for AC system enclosed.
xi.	Manometer Installation across fine filter. Fixing of manometer across the fine filters to be carried out. Manometer is available and free-issue to bidder.	No	1	Manometer across fine filter inside AHU room	Manometer is available and free-issue to bidder. Duct Layout for AC system enclosed.
B.2	**Balance Installation of following Fresh Air Fan Assembly works:**				
i.	Installation of wall mounted Fresh Air Axial Flow Fan of 2250 CMH	No	1	Fresh air fan, its motor, damper, rain protection cowl & other materials are loosely available at stores. These are to be assembled and mounted on the wall of AHU room.	All Materials are available in stores and free issue to bidder. Wall opening is already provided in the AHU Room. Duct Layout for AC system enclosed.
ii.	Installation of Motor for fresh air Axial fan	No	1		
iii.	Installation of Volume control Damper (420x420mm) at the outlet of fan	No	1		
iv.	Installation of Rain	No	1		

	Protection Cowl and Bird screen at the suction of fan				
v.	Installation of Connection Piece with filter mounting box	No	1		
vi.	Installation Pre filter (610x610x50 mm) at fan suction	No	1		
vii.	Installation of Fine filter (610x610x150 mm) at fan discharge	No	1		
viii.	Installation of Filter frame (610x610x300 mm)	No	1		
ix.	Fixing of fan casing assembly at wall with M10x 100L Anchor bolt , MS Flat (40x6 mm), Rubber Gasket - 3mm Thk.	Nos	4		
B.3	**Balance Installation of Instrumentation works:**				
i.	Installation of Pressure Gauges along with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation) on chilled water & cooling water pipes. Making necessary opening in the pipe and installation of pressure gauges using hook-up materials to be carried out by bidder.	Nos	22	(a) 16 nos of Pressure Gauges (PG) at Chilled Water & Cooling Water piping in AC Plant Room. (b) 6 nos of Pressure Gauges at Chilled Water piping in AHU Room.	These materials are to be procured by bidder under clause no. 4.1 (a), sl.no.7 above. PGs with hook-up materials to be erected as per P&ID and Piping Layout for AC System which is enclosed with Specification.
ii.	Installation of temperature Gauges along with Hook up materials (Thermowell, Socket, Nipples, Adapter required for installation) on chilled water & cooling water pipes. Making necessary opening in the pipe and installation of temperature gauges using hook-up materials to be carried out by bidder.	Nos	10	10 nos of Temperature Gauges (TG) at Chilled Water & Cooling Water piping in AC Plant Room.	These materials are to be procured by bidder under clause no. 4.1 (a), sl.no.8 above. TGs with hook-up materials to be erected as per P&ID and Piping Layout for AC System which is enclosed with Specification.

iii.	Installation of Level Switches along with Hook up materials (Socket, Nipples, Adapter required for installation)	Nos	3	(a)1 No Level Switch for Make-Up Water Expansion Tank in AHU Room (b) 2 No Level Switch for Basin of FRP Cooling Tower at Roof of the Control Building	These materials are to be procured by bidder under clause no. 4.1 (a), sl.no.4 above. Equipment Layout for AC system enclosed.
iv.	Installation of Float valve for expansion tank in AHU room. Making opening in expansion tank for provision of installation of float valve to be carried out by vendor.	No	1	1 No Float Valve for Make-Up Water Expansion Tank in AHU Room	Float valve is available in Stores and free-issue to bidder. Equipment Layout for AC system enclosed.
B.4	**Balance Piping Works:**				
i.	Balance Cooling Water Pipe connections to FRP Cooling Towers (Pipe Size : 100 NB); Cooling water lines are already erected from CW Pumps upto 3 meters near to FRP Cooling tower (CT) on the control building. This pipe to be extended and connected to each of two FRP cooling tower basic flanges.	Mtrs	10	For Erection of Cooling water piping for interconnection with FRP cooling tower at roof of control room for Cooling Tower; Approx length of the pipe : 10 mtrs	All Pipes Materials are available in Stores. Piping Layout for AC system enclosed.
ii.	Erection of 100 NB suction piping from suction header to chilled water pumps (two)	Mtrs	4 m each	This is 100nb pipe located in AC plant room.	All Pipes & fittings Materials are available in Stores and free issue to bidder. Piping Layout for AC system enclosed.
iii.	Erection of 100 NB Discharge piping from chilled water pumps (two no.) to Discharge header.	Mtrs	4 m each	This is 100nb pipe located in AC plant room.	All Pipes & fittings Materials are available in Stores and free issue to bidder. Piping Layout for AC system enclosed.

iv.	Erection of 100 NB suction piping from suction header to cooling water pumps (two)	Mtrs	4 m each	This is 100nb pipe located in AC plant room.	All Pipes & fittings Materials are available in Stores and free issue to bidder. Piping Layout for AC system enclosed.
v.	Erection of 100 NB Discharge piping from cooling water pumps (two no.) to Discharge header.	Mtrs	4 m each	This is 100nb pipe located in AC plant room.	All Pipes & fittings Materials are available in Stores and free issue to bidder. Piping Layout for AC system enclosed.
B.5	**Erection of Insulation Works for Chilled Water Pipings :**				
i.	Erection of PUF Insulation material with Aluminium cladding for Chilled Water Pipe (100NB) size. PUF Insulation Density : 24Kg/cm3 ; Thk: 50 mm) Erection consumables like adhesive, cleats etc shall also be included by bidder.	Mtrs	140	For Chilled Water Interconnecting Piping between : (a)Chillers In/out to AHU In/out (100 NB Pipes)	Bidder to procure this material under clause no. 4.1 (a) sl.no. 5 above. Piping Layout for AC system enclosed.
ii.	Erection of PUF Insulation material with Aluminium cladding for Chilled Water Pipe 40 NB size. Erection consumables like adhesive, cleats etc shall also be included by bidder.	Mtrs	35	For Chilled Water Interconnecting Piping between : (b)AHU Drain inside AHU room (40 NB Pipes)	Bidder to procure this material under clause no. 4.1 (a) sl.no. 5 above. Piping Layout for AC system enclosed
iii.	Erection of PUF Insulation material with Aluminium cladding for Chilled Water Pipe 32NB size. Erection consumables like adhesive, cleats etc shall also be included by bidder.	Mtrs	25	For Chilled Water Interconnecting Piping between : (c)Chiller Drain in AC Plant room (32 NB Pipes)	Bidder to procure this material under clause no. 4.1 (a) sl.no. 5 above. Piping Layout for AC system enclosed
B.6	**Valves Installation Works :**				
i.	Installation of 100 NB Butterfly valves (Flanged connection); Interconnection Pipes for Chillers and Pumps (Chilled water & condenser water pump) and upto the FRP Cooling towers at roof of the	Nos	18	1. Eight valves to be installed in suction & discharge sides of two no. chilled water pumps and two no. cooling water pumps. 2. Six valves for suction & discharge sides of	16 Nos of valves are available in stores and shall be treated as free-issue to bidders. Balance 2 no. valves to be procured by bidder under clause no.

	control building are already erected. These Valves are to be envisaged at suction and discharge lines of the Chiller and Pumps in AC Plant Room and at Suction and Discharge of FRP Cooling Tower at Roof of Control Building. Vendor to cut the already installed pipe line for accommodating / installation of Valves.			two no. chiller units. 3. Four valves on the suction and discharge piping of two FRP cooling towers each.	4.1(a) sl.no.6 above. Piping Layout for AC system enclosed.
ii.	Installation of 80 NB Butterfly valves (flanged connections) ; These flanged valves are to be installed on suction & discharge sides of chilled water lines on each of three AHU's in AHU Room. This chilled water lines to AHU's are already erected. Vendor to cut the already installed pipe line for accommodating / installation of Valves.	Nos	6	For suction & discharge sides of chilled water lines for each of three AHUs in AHU Room	All six valves are free-issue to bidder. Piping Layout for AC system enclosed.
iii.	Installation of 100 NB Globe Valve (flanged connection); These valves are to be installed at Chilled water pipes at chiller discharge line in AC Plant Room. Chilled water lines to pumps are already erected. Vendor to cut the already installed pipe line for accommodating / installation of Valves.	Nos	3	One valve on Discharge pipeline of Chilled water service for each of the three AHUs in AHU room.	All three valves are free-issue to bidder. Piping Layout for AC system enclosed.
iv.	Installation of 100 NB Strainers (flanged connection) These strainers are to be installed on suction lines of each of two chilled water Pumps and each of two cooling water pumps in AC Plant room. Vendor to cut the already installed pipe line for accommodating / installation of Valves.	Nos	4	1. One strainer on suction line of each of the two chilled water pumps 2. One strainer on the suction of each of two cooling water pumps.	All four strainers are free-issue to bidder. Piping Layout for AC system enclosed.
v.	Installation of 100 NB check valves (flanged connection)	Nos	4	1. One valve on suction line of each of the	All four check valves are free-issue to

	These valves are to be installed on suction lines of each of two chilled water Pumps and each of two cooling water pumps in AC Plant room. Vendor to cut the already installed pipe line for accommodating / installation of Valves.			two chilled water pumps 2. One vlave on the suction of each of two cooling water pumps.	bidder. Piping Layout for AC system enclosed.
vi.	Installation of 80 NB Balancing Valves (flanged connections) ; These valves are to be installed on the discharge lines of the three AHUs in AHU room. Vendor to cut the already installed pipe line for accommodating / installation of Valves.	Nos	3	One valve on discharge line of each of three AHUs in AHU room.	All three valves are free-issue to bidder. Piping Layout for AC system enclosed.
vii.	Installation of 20 NB Gate Valves ; These valves are to be installed on drain lines of the FRP cooling tower make-up lines and expansion tank make-up lines. Vendor to cut the already installed pipe line for accommodating / installation of Valves.	Nos	8	1. Two valves each on make-up lines of each of two FRP cooling towers located on the roof of control building. 2. Four valves on make-up lines of expansion tanks in AHU room	All eight valves are free-issue to bidder. Piping Layout for AC system enclosed.
viii.	Installation of 32 NB Gate Valves ; These valves are to be installed on drain lines of the FRP Cooling Tower. Vendor to installed on the already erected pipelines.	Nos	2	For Drain Line of FRP Cooling Tower at Roof of Control Building	Valves are free-issue to bidder. Piping Layout for AC system enclosed.
ix.	Installation of 3 way Motorised Valves of 80 NB (flanged connection); These valves are to be installed on the discharge lines of each of the three AHUs in AHU room. Vendor to lay the bypass pipe from AHU and install the 3 way valves. Apprx. Length of the 80NB pipe : one meter for one AHU. Total 3 meters.	Nos	3	The bypass line of 80NB size shall also be erected for each AHU and install the valve in bypass pipe line. The approximate length of pipeline is 1 m. All three AHUs are to be provided with this arrangement.	All valves and pipe are free issue to bidder. Piping Layout for AC system enclosed.

B.7	**Control cables**				
i.	Cabling works for Fire dampers, Humidifiers, Humidistats and Thermostats; Cable Size : 3 C X 2.5 mm2. Interconnecting Cabling works to be carried out from AHU panel to Fire Damper actuators, Humidifiers, humidistats, thermostats and 3 way valves inside AHU Room. Commissioning of the thermostats, humidistats and fire dampers and other instruments are to be carried out by vendor.	Mtrs	540	(a) Interconnecting Cabling works from AHU panel to Fire Damper actuator inside AHU Room. (b) Interconnecting Cabling works from AHU panel to Humidifiers, Humidistats, Thermostats and 3 way motorised valve inside AHU room.	All Cables are free issue to bidder. P&ID for AC system enclosed.
B.8	**Balance Chilled Water & Condenser Water Pumps Erection and Commissioning works:**				
i.	Pocket Grouting works and Radial Alignment for Chilled and Condenser water Pumps Installation. Chilled and condenser water Pumps (4 Nos) are already placed on the respective foundations in AC Plant room. Foundation bolts are to be procured by bidder.	Nos	24	For Chilled and Condenser water Pumps (4 nos.) shall be aligned, fixed with foundation bolts and grouted. Any other balance work for completion pump erection must be carried out by bidder and pumps shall be fully erected.	Foundation Bolt materials are to be procured by bidder under cl.no. 4.1(a) sl.no.3 above. Bidder to fix foundation bolts to the equipment and complete balance erection of equipment.
B.9	**Balance Installation for FRP Cooling Towers**				
i.	Installation of Cooling Tower Fan Motor Fixing at top of the Cooling Tower Body. Cooling tower is already placed at the respective foundations at roof of the control building.	Nos	2	For FRP Cooling Towers at Roof of Control Building	All Materials available in stores and free-issue. FRP Cooling Towers have been placed on foundation. Equipment layout for AC system is enclosed.
ii.	Fixing or Base Grouting of FRP Cooling Tower by Anchor Fastener. There are two FPR cooling towers and they are already	Nos	2	For FRP Cooling Towers at Roof of Control Building	Equipment layout for AC system is enclosed.

	placed foundations at the roof of the control building. Both towers are to be anchored with anchor fastners. Anchor fastners are to be procured by bidder.				
B.10	**Balance Erection work for Expansion Tank (1 M3)**				
i.	Base Frame Fixing of Expansion Tank on expansion tank Foundation. Expansion tank is already placed on the foundation. Fixing of the expansion tank (4 nos) to be carried out by vendor. Anchor fastners are to be procured by bidder.	Nos	1	For Make-up water Expansion Tank inside AHU Room	Equipment layout for AC system is enclosed.
ii.	Application of Thermal Insulation on the Surface of Expansion Tank to be carried out by vendor. Necessary erection hardwares such as adhesives, cleats etc. are to be provided by Bidder to make the system complete.	Sqmt	10	For Make-up water Expansion Tank inside AHU Room	All duct Insulation Materials are are free-issue to Bidder. Equipment layout for AC system is enclosed.
iii.	Installation Air Vent at top of Expansion Tank. Provision for installation of Air vent a the top of the expansion tank to be made by vendor.	No	1	For Make-up water Expansion Tank inside AHU Room	Air vent material is free-issue to vendor. Equipment layout for AC system is enclosed.
B.11	**Balance Water Cooled Chillers works:**				
i.	Installation of Anti-Vibration pads (AVP) for 2 nos. of chiller skids. 12 nos. of Pads are to be provided for each chiller.	Nos	24	For Installation of Chillers (2 Nos) at foundation in AC Plant room	Anti vibration pads are to be procured by bidder under cl.no. 4.1(a) sl.no.1 above. Chillers have been placed on foundation. Bidder to lift the chiller units, place the pads and grout the chillers with foundation bolts.

ii.	Grouting works after installation of Vibration Pads. 6 Nos. of foundation bolts are envisaged for each chiller.	Nos	12	For Installation of Chillers (2 Nos) at foundation in AC Plant room	Foundation bolts are to be procured by bidder under cl.no. 4.1(a) sl.no.2 above.
B.12	All the free-issue materials specified in Cl.4.1 (b) are available in site stores. Bidder to shift the free-issue materials from BHEL stores to site. The cost of transporting materials from stores to site shall be included in the bid.				The cost of material handling shall be included in the each of erection activity. No separate price shall be quoted.
B.13	All erection consumables like welding electrodes, filler wires, gas cylinders, etc., that are required for completion of all the activities listed, shall be arranged by bidder. Price of these items shall be included in the main package price. No separate price for the same shall be offered.				Price of these items shall be included in the main package price. No separate price for the same shall be quoted.
B.14	All the tools & tackles that are required for executing the erection works shall be arranged by bidder and shall be included in base prices. No separate price shall be quoted.				Price of these items shall be included in the main package price. No separate price for the same shall be quoted.
B.15	All the pipelines, that are erected by bidder shall be hydraulic tested by the bidder. Cost of hydraulic testing shall be included in the base price of bid.				Price of these items shall be included in the main package price. No separate price for the same shall be quoted.
B.16	All the structural support materials like				

	angles, channels etc that required shall be included by bidders in the base price. No separate price to be provided.				
B.17	Bidders to include all the works that are required to complete the erection of HVAC system. The works that are specifically excluded in this specification shall not be quoted by bidder.				

c.

4.2 BOQ for Balance Supplies and Pending Installation for Ventilation System Package :

a. Following materials shall be supplied by the bidder.

S. No.	Item Description	Unit	Qty.	Applicable Sub System / Equipment	Remarks
A	**BALANCE SUPPLY OF MATERIALS DESCRIPTIONS**				
1	Fixing Bolt for Motors of Centrifugal Blowers Bolt Size : M16x75L	Nos.	8	For Installation of one no. of Blower motor at each of the two centrifugal Blower **skid** in Ventilation Room	Centrifugal Blowers are placed on the foundation. Bidder to fix one motor for each of the two Centrifugal Blower skid.
2	Outlet Canvas connection (At fan outlet) with Nuts& Bolts Size : 1296x2067 mm ; Length 200 mm (approx.)	Nos.	2	For connecting the outlet of Centrifugal Blowers with Duct in Ventilation Fan Rooms.	Bidder to connect the canvas connections between fan outlet and duct inlet.
3	Anti-Vibration Pads for Centrifugal Blower Installation Rubber Pad Size : 150 x 150 x 12 mm	Nos.	32	For Installation of Blower Fans (2 Nos) at foundation in Ventilation Fan Rooms.	Bidder to place the pads between the blower skid and foundation.
4	Foundation Bolt for Blower Installation Fan Foundation Bolt Size : M16 x 200L	Nos.	16	For Fixing of Blower Fans (2 Nos) at foundation in Ventilation Fan Rooms.	Bidder to fix foundation bolts and complete the erection works.
5	ISA 40x40x5 (MS) for duct support structures	M	250	For Frame & Bracing of duct Plenum in	ISA members /support are

				Ventilation Rooms.	required for supporting the Ventilation ducting.
6	Air Pressure Switch in duct plenum	No.	1	For the Duct Plenum inside Ventilation Fan Room.	The Air Pressure switch to be erected in the duct plenum and corresponding wiring to the control panel and termination to be carried out by vendor.
7	Isolating Switch for Roof Exhausters (15 nos for STG & 10 nos for GT roof fans)	Nos	25	For isolating the earth connection from power cable; Local on-off)	Isolating switch to be erected for each roof exhausters.
8	Propeller Fans with motors ; Capacity : 1000 cmh Complete assembly of propeller fans.	Nos.	8	Provided for following areas : (a) Toilet/Pantry in Switchgear Building - 5 Nos (b) Toilet in GBC Hall -1 No © Toilet in DM Plant - 1 No (d) Lift Machine Room- 1 No	Cowls for all propeller Fans are available & need not be included in supply.

b. Following erection works to be carriedout by bidder.

B	PENDING INSTALLATIONS DESCRIPTIONS	Unit	Qty.	Applicable Sub System / Equipment	Remarks
B.1	**Erection of Centrifugal Blowers in Ventilation Fan Room**				
B.1.1	Centrifugal Fan of 85000 CMH & 50mm St. Press.				2 Nos Centrifugal Blowers are placed at the foundation; Grouting to be carried out with Anti Vibration Pads and Foundation Bolts after Base
B.1.1.1	Blower Base Alignment for Centrifugal Fans	Set	2	For Blowers inside Ventilation Room.	
B.1.1.2	V Belt Fixing and Belt Cover attachement	Set	2	For Blowers inside Ventilation Room.	

					alignment.
B.1.1.3	Installation of Anti-Vibration pads (AVP) for 2 nos. of Blower Fans skids. Blowers are already placed on foundation. The blower shall be lifted and anti-vibration pads shall be placed. The blowers shall be fixed to the foundation using foundation bolts and then grouted.	Nos.	32	For Blowers inside Ventilation Room.	Anti-vibration pads are to be procured by bidder as per cl. No. 4.2(a) sl.no.3. Foundation bolts are to be procured by bidder as per cl. No. 4.2 (a) sl.no.1 above.
B.1.1.4	Installation of Elec. Motors ; Rating : 22 KW Shifting , Placement, alignment and Frame Fixing Bolt (Blower & Motor Base Frame)-M16X50L : 12 Nos.	Nos.	2	For Centrifugal Blowers inside Ventilation Room.	Motors are available in BHEL stores and bidder to consider these materials as free-issue. These are to be shifted to site and Fixed on the blower Skid.
B.1.2	Erection of air intake lovre with filter assembly.				
B.1.2.1	Erection of Air Intake Louver with Bird Screen in Blower Fan Rooms in Switchgear Building ; Size of Intake Louvers : 3075x3690 mm	Nos.	4	For Centrifugal Blowers inside Ventilation Room.	Material Available along with Anchor Fasteners at BHEL stores. Bidder to consider these materials as free-issue.
B.1.2.2	Installation of Air intake filter in Intake Louvers; Size of each Filter: 610x610x150Thk.	Nos.	60	For Centrifugal Blowers inside Ventilation Room.	Material Available in BHEL stores with filter frames. Bidder to consider these materials as free-issue.
B.1.2.3	Erection of Filter frame (3075x1845x150mm)	Nos.	4	For Centrifugal Blowers inside Ventilation Room.	Material Available along with Anchor Fasteners; Only Installation to be carried out.
B.1.3	Erection of canvas Connection piece (At fan outlet) with Nuts& Bolts Size : 1296x2067 mm & 200mm length.	Nos.	2	For Centrifugal Blowers inside Ventilation Room.	Foundation bolts are to be procured by bidder as per cl. No. 4.2 (a) sl.no.2 above.

B.1.4	Erection of Outlet Damper (1987x1216mm) with Nuts& Bolts for each blower.	Nos.	2	One outlet damper for each blower in blower room.	Dampers are free-issue to bidder and available in store. Shall be shifted from stores to site for erection.
B.2	**Fabrication and Erection of Air Distribution Ducts :**				
B.2.1	Ducting works for Fabrication of duct; Fabrication of Duct portion envisaged for Plenum inside Blower room to be carried out. Necessary duct connection method is indicated in enclosed duct layout. Approx. size of duct is 3000mm x 1800 mm.	Sqmt	110	For Plenum Duct Portions in Blower Fan Room	All Duct Material Available & shall be free issue to bidder. Fabrication of 110 sqmt duct to be carried out for common Plenum portions.
B.2.2	Installation of Duct works (Plenum & Branch Duct) in the Switchgear Room Necessary anchor fasteners and hanging rod required for duct support / duct installation to be carried out. Approx. size of duct is 3000mm x 1800 mm.	Sqmt	190	For Plenum Duct Portions in Blower Fan Room	ISA 40x40x5 for Frame & Bracing of Plenum , shall be procured by bidder as per clause 4.2 (a), sl. No. 5.
B.2.3	Installation of Supply Air Grills with Volume Control Dampers in Ducts :				
B.2.3.1	Fabrication of duct collar for fixing of Grills and Installing Grills . Size : 700X300 mm	Nos.	30	i. Fabrication of Duct Collars for Grills in the duct of switchgear room. ii. Fixing the Grills in switchgear room	All Material Available and shall be free-issue to bidder.
B.2.3.2	Fabrication of duct collar for fixing of Grills and Installing Grills . Size : 725X1000 mm	Nos.	5	iii. Fabrication of Duct Collars for Grills in the duct of switchgear room. iv. Fixing the Grills in switchgear room	All Material Available and shall be free-issue to bidder.
B.2.4	Installation of Volume Control Dampers in Duct; Size : 1300x1100 mm	Nos.	2	For Ducting inside Switchgear Room	All Material Available and shall be free-issue to bidder.
B.2.5	Installation of Motorised Fire Damper with Actuators in				

	Duct Plenum. This Motorised Fire damper is be erected in duct plenum. Necessary cable laying and termination works from fire damper actuator to Ventilation panel and Fire Alarm Panel to be carried out by vendor.				
B.2.5.1	Fire Damper-1 (1950x1300 mm)	No	1	For Ducting inside Switchgear Room	All Material Available and shall be free-issue to bidder.
B.2.5.2	Fire Damper-2 (2500x600 mm)	No	1	For Ducting inside Switchgear Room	All Material Available and shall be free-issue to bidder.
B.2.6	Installation of Gravity Damper in Swithgear Room ; Gravity Damper Size : 550x550 mm Wall opening and Material for Gravity Dampers are available; 7 Nos are to be erected.	Nos.	**7**	Inside Switchgear Room	All Material Available and shall be free-issue to bidder.
B.2.7	Installation of Air Pressure Switch along with Hook up materials (Socket, Nipples, Adapter required for installation) in the Duct Plenum in Blower room	No.	1	For Duct Portions in Blower Fan Room	Air Pressure Switch Material not Available; Same is mentioned in clause no 4.2 (a)Sl. No. 6 above.
B.2.9	Installation of Inclined tube manometer; Fixing of manometer across the fine filters to be carried out.	Nos.	2	For Blower Fan Room	All Material Available and shall be free-issue to bidder.
B.3	**Installation of Roof Exhauster Fans**				
B.3.1	Fixing of Rain Protection Hoods at top of the Roof Exhausters for STG Building; Capacity: 40000 CMH. Roof Exhauster assembly along with Casing is already installed. Fixing of Rain Protection Hoods at top of the Roof Exhausters only to be carried out by vendor.	Nos	15	Roof Exhausters for STG Building	Material Available and free issue to the bidder. Fixing of roof exhausters to be carried out.

B.3.2	Installating roof exhausters with Rain protection hoods on the roof of GTG Building ; 30000 CMH capacity.	Nos	10	i. Fixing of the Roof exhausters on the respective foundations. ii. Fixing of Rain protection Hoods on each roof exhausters.	Material Available and free issue to Bidder. Fixing of roof exhausters and hoods are to be carried out.
B.4	**Installation of Wall Mounted Exhauster Fans**				
B.4.1	Installation of Exhaust Fan ; Capacity of each fan: 5000 cmh	Nos	11	Air Compr. Build: 9 ; SWAS room : 1 ; CW Chlorination : 1	Material Available at Stores and free-issue to bidder.
B.4.2	Installation of following Exhaust Fan along with motor assembly ; Capacity of each fan : 10000 cmh	Nos	11	Pending Installation for following areas : BFP Pump House : 4 ; CW Pump House : 7	Material Available at Stores and free-issue to bidder.
B.4.3	Installation of Propeller Fan each of Capacity: 1000 cmh.	Nos	8	Pending Installation for following areas : (a) Toilet/Pantry in Switchgear Building - 5 (b) Toilet in GBC Hall -1 (c) Toilet in DM Plant- 1 (d)Lift Machine Room-1	Material Not Available; Bidder to procure the same as per clause no 4.2 (a) Sl. No. 07 above.
B.5	**Fixing of Rain Protection Cowl (Anchoring)**				
B.5.1	Fixing of Rain Protection Cowl for fan capacity of 5000 cmh;	Nos	18	For following areas : Air Compr. Build: 9 ; SWAS room : 1 ; CW Chlorination : 1 ; DM Plant : 7;	Material Available at Stores and free-issue to bidder.
B.5.2	Rain Protection Cowls for fans capacity of 10000 cmh;	Nos	39	For following areas : BFP PH : 4 ; DG room: 2 ; Fire water PH : 9 ; CW PH : 7 ; Cable cellar room : 4 ; Battery room : 4 ; GBC Hall : 9 ;	Material Available at Stores and free-issue to bidder.

B.5.3	Rain Protection Cowls for fans each of capacity 1000 cmh ;	Nos	8	For following areas : (a) Toilet/Pantry in Switchgear Building - 5 Nos (b) Toilet in GBC Hall -1 No © Toilet in DM Plant - 1 No (d) Lift Machine Room- 1 No	Propeller Fans Material not Available; Bidder to procure the same as per clause no 4.2 (a) Sl. No. 07 above.
B.6	**Balance Electrical Works**				
B.6.1	Installation of Local control Panel for pressurized Ventilation System	No	1	For Ventilation Blowers; Inside Blower Room.	Material Available and shall be free-issue to bidder.
B.6.2	Installation of Isolating Switch (For isolating the earth connection from power cable; Local on-off) ;	Nos	25	15 nos for STG & 10 nos for GT roof fans	Isolator Switch Material not Available. Same is mentioned in SL. No. A. 7 above in Balance Supply Portion. Only Isolator switch for Roof Exhauster to be Installed.
B.6.3	Laying of Control Cable 3C x 2.5 sq.mtr. Interconnecting control cable from Ventilation Panel to motor of Centrifugal Blowers inside Blower room.	M	200	For Ventilation Blowers; Inside Blower Room.	Cable Material Available and shall be free- issue to bidder.
B.7	**Testing and Commissioning of Ventilation Blowers; Capacity : 85000 CMH & 50mm St.**	Nos	2	For Ventilation Blowers; Inside Blower Room.	Testing and Commissioning of 2 Nos. of Ventilation Blowers to be Carried out.
B.8	All the free-issue materials specified in Cl.4.1 (b) are available in site stores. Bidder to shift the free-issue materials from BHEL stores to site. The cost of transporting materials from stores to site shall be included in the bid.				The cost of material handling shall be included in the each of erection activity. No separate price shall be quoted.
B.9	All erection consumables like welding electrodes, filler wires, gas cylinders, rivets, small bolts & nuts, screws, anchor				Price of these items shall be included in the main package price. No separate price

	fasteners etc., that are required for completion of all the activities listed, shall be arranged by bidder. Price of these items shall be included in the main package price. No separate price for the same shall be offered.				for the same shall be quoted.
B.10	All the tools & tackles that are required for executing the erection works shall be arranged by bidder and shall be included in base prices. No separate price shall be quoted.				Price of these items shall be included in the main package price. No separate price for the same shall be quoted.
B.11	All structural materials required for the erection works shall be included in base price. No separate price shall be quoted for structural materials.				
B.12	The erection works that are not listed in this scope, but required to complete the erection of system shall be included and quoted by the bidder. The works that are specifically excluded in this specification shall not be quoted.				

4.3 Painting: Bidder shall include the painting of all pipe work of HVAC system. Also please refer clause no. 6 of this specification.

4.4 Commissioning: Bidder to commission (a) HVAC system and (b) Ventilation system.

5. Exclusions:

5.1 Exclusions in HVAC system:

a. Repairs & maintenance of chillers, AHUs, pumps etc, that needs replacement of parts. (During the commissioning activity, the equipment – chillers, AHUs, Pumps etc - develop any repairs or defects, the same shall be listed and reported to BHEL.)

5.2 Exclusions in Ventilation system:

a. Repairs & maintenance of centrifugal blowers & its drives, that needs replacement of parts, shall be excluded from bidder.

5.3. All civil works.

6. CLARITY OF SCOPE IN OTHER AREAS (SCOPE MATRIX):

6.1. Mechanical

MECHANICAL				
Sl. No	Item	By BHEL	By Bidder	Remarks
1.	Support structure if any required for installation of HVAC Equipment such as pipes , valves , insulation, ducts, diffusers, dampers and other accessories etc.	No	Yes	

6.2. Civil

CIVIL				
S No.	Item Description	By BHEL	By Bidder	Remarks
1.	Making openings in walls for Ventilation fans, ducts , pipes etc., and making them good after installation for the purpose of installing bidder's supplied items	Yes	No	
2.	Supply and fixing of framework for ducts, fans , diffusers arrangement	No	Yes	
3.	All false ceiling work, illumination except providing frames for grills / diffusers.	Yes	No	Suitable support for the diffuser shall be by bidder.

6.3. Electrical

ELECTRICAL				
S No.	Item Description	By BHEL	By Bidder	Remarks
1.	Cabling between HVAC control panels for HVAC system (Fire Damper) and fire Alarm Panel and other instruments	No.	Yes	
2.	Connection and termination works for HVAC control panels such as cable glands , lugs and equipment.	No	Yes	

7. PAINTING

7.1. All protective paints for the protection of weld joint fit-ups, application of primers on finished weld joints are in the scope of contractor.

7.2. The primer and thinner will be provided by contractor as part of scope of work along with other like arrangements for surface preparation and paint application like sand/shot-blasting, consumables like surface cleaning agents, paint brush, brush cleanser, labour and necessary tools and plants as required for completion of work. Price of these items shall be construed to be included in the main package price. No separate price for the same shall be offered.

8. DEVIATIONS TO SPECIFICATIONS:

8.1. **No deviation on the "scope of work furnished in cl. No. 4" is acceptable.** Bidders are advised to quote strictly as per BHEL's specification requirements. Any deviation to the specification or omission of any part of scope by bidder is not permissible. In such cases, the quotation/ bid shall be liable for rejection. Otherwise bidder shall comply with specification without any additional price implications on the omitted scope/deviation to participate in the bid.

8.2. Bidders may raise pre-bid queries on the specification before the cut-off date. The same shall be reviewed by BHEL and suitable clarification shall be provided to all bidders. Bidders are advised to use the format attached with this specification (Annexure -03) to raise pre-bid queries. All such applicable deviations /clarification shall have cross reference to page number /section / clause /para etc. of this specification or its annexure with proper reasons for the deviations for purchaser's consideration. Any such applicable deviations /clarification not listed under the above section, even if reflected in any other portion of the bidder's proposal shall not be considered applicable.

9. PRICE BID FORMAT

9.1. The unit rates of all the items quoted by the bidder shall firm till the execution of contract.

9.2. For Price bid evaluation criteria is indicated in the Price bid Format (Annexure-02).

9.3. In case, additional services are required over and above mentioned quantity, bidder to provide the services for the same as per unit rate mentioned in the price bid format.

9.4. All the items included in the price bid format shall be quoted by the bidder as per tender specification and subsequent tender stage correspondences, if any. Responsibility of ensuring correctness & completeness of scope of supply as per spec. requirement solely lies with bidder.

9.5. The BOQ indicated in this price format is based on estimate and for the purpose of tender only. However any variation in quantities during detailed engg. stage based on actual requirements.

9.6. The Price Bid format lists the major break-up of the items in the package envisaged. Any specific hardware/software/item/ etc. required as per tender specification or subsequent tender correspondences or for desired satisfactory operation of package or due to good-engineering practice or as prescribed by relevant/applicable code/standard, but not listed in the price bid format, shall be deemed to be included in the basic price quoted by the bidder.

9.7. Bidder to note that the BOQ (Price Bid format) has been generated based on approximations and is purely for tender purposes only. To that extent the total final BOQ may vary to an overall +30%, due to actual design conditions & actual site conditions, subject to approval of BHEL. However, variations of the individual quantities may be more than 30% on either side, subject to approval of BHEL. Also bidder to note that certain items envisaged presently in the BOQ may get deleted based upon actual design conditions & actual site conditions, subject to approval of BHEL.

10. LIST OF ANNEXURES:

Sl. No.	Name Of annexure	Document number
1.	Special Condition of Contract	
2.	Price bid format	PEMC 07301 Rev.00
3.	Pre-Bid query format	---
4.	P&ID for AC system	NAMRUP/8648 Rev.04
5.	Equipment Layout for AC System	NAMRUP/8630 Rev.04
6.	Piping Layout for AC system	NAMRUP/8632 Rev.01
7.	Ducting Layout for AC system	NAMRUP/8631 Rev.05
8.	Ducting Layout for Ventilation System	NAMRUP/8734 Rev.08
9.	Actual Site Photographs for AC System	
10.	Actual Site Photographs for Ventilation System	

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	30.01.18	ORIGINAL ISSUE	--SD---	---SD---

Ref. Doc.