

SECTION – III

	प्लाज़्मा अनुसंधान संस्थान	
	Institute for Plasma Research भाट, निकट इन्दिरा पुल, गांधीनगर - ३८२ ४२८ (भारत) Bhat, Near Indira Bridge, Gandhinagar 382 428, Gujarat (India) Tel. :- 079 – 2396 2260, 2262, 2263, 2264. Fax :- 079 – 2396 2277 E-mail :- stores@ipr.res.in	

SCOPE OF WORK, TECHNICAL SPECIFICATION, OTHER DETAILS

(Refer Annexure-II: PLANTS MAINTENANCE SCHEDULE for annual maintenance works involved in the AC system & AHUs to keep the equipments in proper and safe operating condition)

IPR having two other campuses as FCIPT and IPR-Extension Lab at Electronic Estate, GIDC, Gandhinagar. Air conditioning systems are installed at these campuses also mentioned in Annexure - I.

The location details are as follows:

FCIPT

A-10/B, G.I.D.C.

Electronics Estate, Sector 25
Gandhinagar
Gujarat-382044

IPR-Extension lab

B 185-189, G.I.D.C.

Electronics Estate, Sector 25
Gandhinagar
Gujarat-382044

A. PLANTS OPERATION:

1. SPECIFIC DUTIES OF OPERATORS:

- Routine operation of the system as per requirement
- Seasonal starting and stopping of the system as per requirement.
- Taking all required readings regularly, maintaining the logbook record up to date with observations, if any.
- Operations like pump down, removing and charging refrigerant, purging, leak testing, evacuation and dehydration etc.
- Cooling water and chilled water system leakage detection in the plant.
- All other routine inspections to ensure smooth running of the plants as well as those which are otherwise related to satisfactory plant operations, viz., safety related checks.

- g) Performing all the operations according to standard methods, without damaging other working parts of the system.
- h) Maintaining and submitting monthly presence record to Section Head / Division Head / Project Leader, AC&WC section along with the routine bill.
- i) Maintaining operation logbook for the inspection of Section Head / Division Head, AC&WC section
- j) Taking adequate insurance cover against all risks for the persons deployed by the contractor.

2. OPERATION TIME:

The period of operation in terms of days and time during the tenure of contract shall be as follows:

- a) Normal Time of operation: 08.30 a.m. to 5.30 p.m.
- b) Normal Operation in a week: Monday to Saturday.
- c) Normal No-Operation Days: Sundays, Three National Holidays, i.e. 26th January, 15th August and 2nd October and closed holidays declared /observed by the Institute.
- d) Extra hours: Before and after the normal time of operation, i.e. before 08.30 a.m. and after 5.30 p.m. including Sundays and other holidays, if warranted.

(Prior intimation will be given to the contractor for carrying out operation outside the office hours mentioned above. The extra hours of operation work shall be got certified by Section Head/Division Head of WC&AC section)

3. MANPOWER ARRANGEMENT:

The tenderer if awarded the contract shall deploy the following manpower for operation and maintenance of plants:

- a) **Supervision:**
The tenderer if awarded the contract, shall depute a **Supervisor** (Diploma holder in Mechanical/Refrigeration & AC having work experience of **at least 5 years** in the Air conditioning/Refrigeration field) who will be responsible for day to day planning of operation/maintenance/material and spares arrangement during regular shift / office hours and he shall co-ordinate with the Section Head/Division Head, AC&WC section to seek clarifications and instructions related to the work contracted to the tenderer.
- b) **For operation of plants:**
 - (i) 5 Nos. of ITI / NCVT / Equivalent in Refrigeration & Air conditioning qualified **skilled operators** with at least 3 yrs. relevant experience in the similar work.
 - (ii) 2 Nos. **semi-skilled operators** during regular shift / office hours.

(iii) 1 No. **electrician** having Diploma / ITI / NCVT in Electrical field with **at least 3 yrs.** relevant experience in the similar capacity plants during regular shift / office hours.

c) **For operation of plants during extra hours:**

(i) 01 No. of ITI / NCVT / Equivalent in Refrigeration & Air conditioning qualified **skilled operator** with at least 3 yrs. relevant experience in the similar work and 1 No. **semi-skilled operators** for operation during extra hours operation for each plant (SST1 Air Conditioning Plant/ KBAC/ TBAC).

d) **Supervision:**

(i) **On Regular Basis throughout the period of Contract**

The tenderer if awarded the contract, shall identify a **Senior Engineer / Senior Supervisor** (having work experience in the similar field) who would regularly visit IPR **once in a week** to inspect and supervise the work to be carried out under the contract. He shall liaise with the Section Head/Division Head, AC&WC section to seek clarifications and instructions related to the work contracted to the tenderer.

(ii) **As and when required:**

The tenderer, if awarded the contract, shall have to deploy, if warranted, a team of experienced mechanic/s and helper/s within a reasonable time to attend to the problems and arrange to solve the same by carrying out necessary repairs and replacement if any, to IPR satisfaction as per the contract.

Preventive / Breakdown / Scheduled / Winter Shutdown maintenance or situation demands suitable manpower, then successful tenderer shall deploy sufficient manpower for maintenance activities:

e) **Dress code for Operators:**

All contractors' personnel must have to wear a particular dress (**Sky blue shirt with Navy blue pant**) with safety shoes and ID-card. Without observing dress code and without safety shoes and ID-card, a contractor's person will not be allowed to enter in the IPR premises in any circumstances.

f) **Contractors' personnel police verification details:**

The contractor must have to submit police verification of character of all personnel deputed at IPR. The contractor also must submit an attested copy of any one of the Govt. issued ID card (Voter card/ Driving License/ Passport/ Pan card/equivalent)

g) **The Contractor shall be Responsible for:**

(i) Deployment of operators in the main plant rooms on continuous basis.

(ii) Withdrawing the operator/s / mechanic/s who is / are not found suitable according to the opinion of the Section Head/Division Head, AC & WC section and replacing him / them with suitable persons.

(iii) Deployment of suitable persons as per the contract for taking over and carrying out operation and maintenance of the plants and equipments in consultation of Section

Head/Division Head, AC & WC section. Deployment of persons who are not qualified and experienced for carrying out the work shall not be permitted. (Proof of qualification of manpower to be submitted at the time of taking over the plants.)

- (iv) Complying with the requirements of IPR security for regulating entry of the persons deployed for the contract. Further, in and out time of the persons deployed by the contractor for various activities under this contract shall be recorded in the prescribed register at the Main Gate. The Contractor shall be required to keep a similar register with the supervisor / Section Head / Division Head of AC & WC section.

B. CONDITIONS FOR PLANTS MAINTENANCE:

The annual maintenance (mechanical and electrical) all in all service contract covers:

1. Preventive maintenance – Preventive Maintenance shall be carried out preferably in the weekends or as instructed by the Section Head / Division Head, AC & WC Section.
2. Break down service – The break down service consists of attending to the complaint within a reasonable time, identification of fault, Working out Repairs and replacement Procedure in consultation with the Section Head/Division Head AC & WC Section, completing the repairs and replacement to the satisfaction and commissioning of the equipments within the targeted time. Please go through the details given under Maintenance / Servicing Schedule given in Annexure II.
3. All the preventive maintenance and break down service must be carried out as per the instruction and time schedule provided by designated Engineer / Section Head / Division Head, AC&WC section. The time schedule shall be prepared and decided in coordination with the designated Engineer / Section Head / Division Head, AC&WC section and it shall be strictly adhered to.
4. The temperature and humidity conditions in the air-conditioned areas will have to be recorded daily.
5. The Contractor shall maintain daily reports as per the format as required by the designated Engineer / Section Head / Division Head, AC&WC section. The said daily reports maintained by contractor shall be got countersigned by designated Engineer whose instructions would be strictly followed. Monthly report covering the Preventive Maintenance and Break Down Service shall be prepared and submitted to Section Head / Division Head, AC&WC section. A brief monthly report form may be got approved by the Section Head / Division Head, AC & WC for compliance.
6. The Contractor shall be responsible to carry out all repairs of the equipments involving repair or replacement of components. The details of repair and replacements are given in Maintenance / Service Schedule – Annexure II.
7. The Contractor shall keep enough spares and consumables in stock to meet the requirements during the period of contract. The contractor shall also keep 1 No. 61 Kgs R-22 Gas Cylinder, 1 No. 61 Kgs R-134a Gas Cylinder, 50 Kgs compressor oil, gasket sets, 'O' Ring set etc. at site. Contractor must keep a copy of receipted Challans with entry of Gate and Stores
8. The Contractor shall use only genuine original parts. If it is found otherwise it will be termed as a breach of contract. In case if the original manufacturer do not exist or particular item is phased out, then the other available makes or model of the parts shall be got approved from the concerned engineer or Section Head / Division Head and installed at no extra cost.

9. Notwithstanding as to what is specifically stated, it shall be the responsibility of the successful tenderer to attend to all the preventive maintenance/routine maintenance and repairs and breakdown services including replacements of all parts/components.
10. The repairs must be carried out without damaging other working parts of the system.
11. IPR will not supply any tool / tackle / equipment except power supply and water for any work. After satisfactory completion of each of the work, the Contractor shall get approval from designated Engineer/ (or) Section Head/Division Head / (or) Project Leader-AC&WC section. In case any spares parts, equipment or accessories which supplied by IPR during the maintenance/ repairing/ service purpose on temporary basis, the contractor will be responsible for it and has to be returned back same to IPR in all good manners.
12. Logbook shall be maintained for each plant and the list of work carried out like servicing, maintenance, repairs etc. shall be recorded systematically on a regular basis. The recordings in the logbook shall be got endorsed by the designated Engineer from time to time and verified by the Section Head/Division Head, AC&WC section. The Logbook shall be the basic record for all purposes.
13. **Normally repairing and replacement works should be done at IPR Campus. However, if it is to be taken outside IPR campus to and fro transportation charges including any other charges like transit insurance etc. shall be borne by the contractor.**

C. PENALTY:

1. Failure to provide Manpower as per Clause A.3 above

- a) Penalty for absence of **Supervisor** is Rs. 2000/- per day shall be recovered from the routine bill of the contractor.
- b) Penalty for absence of qualified skilled Operator/ Electrician/ Mechanic is Rs.900/- per day shall be recovered from the routine bill of the contractor.
- c) Penalty for absence of semiskilled person is Rs.800/- per day shall be recovered from the routine bill of the contractor.
- d) Penalty for absence of **Senior Supervisor / Senior Engineer**: Rs.2500/- per visit shall be recovered from the routine bill of the contractor.

The above penalty shall be in addition to the consequential loss the Institute may incur for substituting the persons with same number or more for running the system in view of the failure of contractor to provide manpower.

2. Failure to complete the repair and replacement work by the contractor as per the contract.

Minor repairs and replacement:

A maximum period of 7 days is allowed to the contractor to carry out the minor repairs and replacement. If the Contractor fails to complete the minor repairs and replacement within 7 days, IPR will charge penalty @ Rs. 1000/- per day from the 8th day till completing minor repairs/replacement.

If the repairs/replacement fails to complete within 7 days due to unforeseen reasons/causes, extension of time limit may be granted by the Designated Engineer / Section Head / Division Head, AC & WC Section in writing after reviewing the nature of problem. The decision of designated Engineer / Section Head/Division Head, -AC&WC section in this regard shall be final and binding.

Major repairs and replacement:

Following activities are to be considered as major repairs/ replacement. These need to be carried out within 3 week time. If contractor fails to carry out repairs within 3 week time, IPR will charge penalty @ Rs. 1000/- per day after completion of 3 week time till completing major repairs/replacement.

If the major repairs/replacement fails to complete within 3 week time due to unforeseen reasons/causes, extension of time limit may be granted by the Designated Engineer / Section Head / Division Head, AC & WC Section in writing after reviewing the nature of problem. The decision of designated Engineer / Section Head/Division Head, -AC&WC section in this regard shall be final and binding.

- Screw shaft and rotor repairs / replacement in Screw compressor.
- Crankshaft repairs/ replacement of reciprocating compressor.
- Rewinding of motor of compressors, AHUs and pumps.

Intimation of minor/major repairs/replacement will be communicated through e-mail or letter.

Major repairs and replacement: Please refer Annexure-II

- Screw shaft and rotor repairs / replacement in Screw compressor.
- Crankshaft repairs/ replacement of reciprocating compressor.
- Rewinding of motor of compressors, AHUs and pumps.

3. **CONTRACTOR'S MATERIAL:**

- a. IPR shall not be responsible for the safety of material brought by the contractor to IPR in connection with the contract. The successful tenderer shall be fully responsible for the safe custody of his material.
- b. The contractor shall obtain Gate Pass from IPR for taking out his material from IPR campus. Contractor shall not be allowed to take out any material including his material without a valid Gate Pass to be issued by Section Head / Division Head, AC & WC or Stores Incharge. Normally the Contractor shall not be allowed to take out any material on holidays and before 10.00 Hrs. and after 5.00 p.m. on working days.
- c. All the materials brought to IPR in connection with the work contracted to the Contractor are to be routed through IPR Stores with supporting delivery Challans in triplicate indicating full description, quantity, value etc. This procedure should be followed strictly during the contract period.

ANNEXURE – I

	प्लाज़्मा अनुसंधान संस्थान Institute for Plasma Research	
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SPECIFICATIONS OF PLANT EQUIPMENTS

SR.NO.	DESCRIPTION OF PLANTS / SYSTEMS	CAPACITY	NORMAL HOURS OF OPERATION
Plants for Operation and Maintenance both (Sr. no. 1 to 12):			
1.	KBAC plant	375 TR	8-12 hrs
2.	TBAC plant	200 TR	8-12 hrs
3.	SST1 Air conditioning Plant	375 TR	8-12 hrs
4.	Air Cooled Package units (for Administration & Purchase section) - 7.5 TR x 2 nos.	15 TR	8-12 hrs
5.	Air washer Unit (for He-Compressor Hall)	40000 CFM	8-12 hrs
6.	Air Washer and Scrubber Units (for Canteen, IPR)	Diff. capacities	8-12 hrs
7.	Dx Type Centralize Air Conditioning System (for Canteen, IPR) – 25.5 TR x01 nos.	25.5 TR	8-12 hrs
8.	Ductable Split Air Conditioner (for Canteen, IPR) - 5.5TRx02 nos.	11 TR	8-12 hrs
9.	D.M. Water Plants (for various Water Cooling plants)	6 & 40 CMPH	8-12 hrs
10.	Chiller Package units (for SST-1 Vacuum system experiments) –9 TR x 01 no.	9 TR	8-24 hrs
11.	Soft Water Plant at Pump house	30 CMPH	8-12 hrs
12.	R.F. Water Cooling systems (for various RF & other experimental systems)	Diff. capacities	8-12 hrs
Plants for Maintenance only (Sr. 13 to 42):			
13.	Chiller Package Unit (for Beta Lab Experimental Device)	7.5 TR	8-12 hrs
14.	Chiller Package units (for First wall experiment & LVPD experiment Device) –9 TR x 02 nos.	18 TR	8-12 hrs

15.	Chiller Package unit (for Vacuum furnace experiments)	10 TR	8-12 hrs
16.	Chiller Package Unit (for Laser Experimental Systems)	15 TR	8-12 hrs
17.	Chiller Package Unit (new one for Laser Experimental Systems)	15 TR	8-12 hrs
18.	Chiller Package Unit (for DFD at IPR and IPR-Extension Lab, GIDC, Gandhinagar) – 10 TR x 02 nos.	20 TR	8-12 hrs
19.	Chiller Package Unit (for Plasma Torch Division, FCIPT)	10 TR	8-12 hrs
20.	Chiller Package Unit (for Aditya Vacuum and Diagnostics)	10 TR	8-12 hrs
21.	Chiller Package Unit (for Plasma Torch Division and PSE Division, FCIPT), 3 TR x 2 nos.	6 TR	8-12 hrs
22.	Chiller Package Unit (for Cryo Cooler, IPR Extension Lab, Gandhinagar)	5 TR	8-12 hrs
23.	Chiller Package Unit (for Water Jet Cutting Machine, Workshop, IPR)	2 TR	8-12 hrs
24.	Air Cooled Package unit (for Computer Hall, Mezzanine Floor) - 10 TR x01 nos.	10 TR	24 hrs
25.	Air Cooled Package units (for R.F. Lab.- Ground. & First Floor)- 15 TR x01 nos., 10 TR x01 nos. and 7.5 TR x 2 nos.	40 TR	8-12 hrs
26.	Air Cooled Package units (for Admin Annexure) - 10 TR x 2 nos.	20 TR	8-12 hrs
27.	Air Cooled Package units (Negative NBI Lab, FF, Utility building) – 17 TR x 02 nos.	34 TR	8-12 hrs
28.	Air cooled Package units (for Control room of Aditya Hall)- 11 TR x02 nos. (1W+1S)	22 TR	8-12 hrs
29.	Air Cooled Package units (Seminar Hall, FCIPT, Gandhinagar)-11 TR x 2 nos.	22 TR	8-12 hrs
30.	Air cooled Package unit (for IPR-Extension lab-Ground floor & first floor, GIDC, Gandhinagar) – 11 TR x04 nos.	44 TR	8-12 hrs
31.	Ductable Split Air Conditioner (for Guest house and Student facility building) – 7.5 TR x01 nos., 5.5 TR x01 nos. and 5 TR x 3 nos.	28 TR	8-12 hrs
32.	Ductable Split Air Conditioner (for IPR-Extension lab, GIDC, Gandhinagar)- 8.5TRx02 nos. and 5.5 TRx10 nos.	72 TR	8-12 hrs
33.	VRV Air Conditioning system for LHCD Lab	24 HP	8-12 hrs

34.	Dx Type Centralize Air Conditioning System (for HVPS Lab) – 15 TR x02 nos.	30 TR	8-12 hrs
35.	Dx Type Centralize Air Conditioning System (for APPS Lab) – 25.5 TR x01 nos.	25.5 TR	8-12 hrs
36.	Dx Type Centralize Air Conditioning System (for RHVPS Lab, Utility building, first floor) – 34 TR x01 nos.	34 TR	8-12 hrs
37.	Dx Type Centralize Air Conditioning System (for Neutronics Lab at IPR) – 34 TR (17 TR working + 17 TR standby)	34 TR (17 TR working + 17 TR standby)	8-12 hrs
38.	Dx Type Centralize Air Conditioning System (for diff. Hall and labs in FCIP, Gandhinagar) – 17 TR x01 nos., 11 TR x01 nos. and 8.5 TR x 2 nos.	45 TR	8-12 hrs
39.	Air washer Unit (for Workshop, IPR)	18000 CFM	8-12 hrs
40.	Ventilation Systems (for various plant rooms / Utility Halls / Cryogenic Hall/N2 Baking plant/ other places)	Diff. capacities	8-12 hrs
41.	Kitchen Exhaust Units (for Guest house and student facility bldg.) 6400 CFM x 2 nos.	6400 CFM each	8-12 hrs
42.	HVPS Cooling Tower and CT Pumps with accessories	1000 LPM	8-12 hrs

Sr. No.	Description	Qty.	Capa.	Make	Model	Applications/ details
1.	KBAC Plant Location: Kitchen Basement AC Plant Room					
a.	Screw type, skid mounted water Chiller Package units with in house safety controls, sensors, gauges and Auto loading /unloading devices consists of following equipments:	3 (2W + 1S)	125 TR	YORK	YEWS130SA53 DS3	For comfort Air-conditioning of Aditya hall, Aditya Control room, BETA Lab, Seminar Hall, Library and ground floor offices.
	i) Compressor	3	125 TR	YORK		R-134a based screw type semi hermetic single compressors with instruments and controls like pressure transducers, temperature controller and sensors, motorized valve for loading /unloading, crankcase heater, flow switch, DP switch, refrigerant level sensor etc.
	ii) Condenser	3	125 TR	YORK		Shell and Tube type
	iii) Chiller (Evaporator)	3	125 TR	YORK		Flooded type
	iv) Motor for comp.	3	88 KW	YORK		This is sealed type refrigerant cooled motor mounted on compressor shaft with gear mechanism with soft starter.
	v) Micro Processor Control Panel	3		YORK		This panel gives the status of chilling machine with LCD display and houses the soft starter and other Power / control contactors and electronic controls/circuits. This panel is mounted on each chilling machine.
b.	Chiller Water Pump Sets	3 (2W + 1S)	25 HP	M&P	ET-20/CAT-B2	Back pull out pumps with CG make 25 HP/ 3 Ph/1475 rpm motor, drive package.
c.	Cooling Water Pump Sets	3 (2W + 1S)	15 HP	M&P	ET-19/CAT-B	Back pull out pumps with CG make 15 HP/ 3 Ph/1460 rpm motor, drive package.

d.	Drain Water Pumps	2 (1W + 1S)	2 HP	CG	DWMJ22	Drain water pumps used to drain the water from the condensate collection pits at KBAC plant room.
e.	Air Handling Units					
	i) Library area	1	17000cfm	Thermflow	THA-11with Sidemen's TEFC/ 12.5 Hp/ 4P motor	With drive package, metallic/ PE pre filters, 3 way diverting valve with actuator, sensors and temperature controllers, valves etc. Insulated Ducting, canvass, and grilles, fresh air filters, dampers, electrical solenoid operated fire dampers etc.
	ii) Seminar Hall	1	10000 cfm	Thermflow	THA-11 with Sidemen's TEFC/7.5 Hp/4P motor	As mentioned above
	iii) Beta Lab.	1	15000 cfm	Thermflow	THA-9 with Sidemen's TEFC/12.5 Hp/4P motor	As mentioned above
	iv) Aditya Hall-A	1	18000 cfm	Weathermake	WH-11 with KEC TEFC/12.5 Hp/4Pmotor	As mentioned above
	v) Aditya Hall-B	1	15000 cfm	Weathermake	WH-7 with KEC TEFC/12.5 Hp/4P motor	As mentioned above
	vi) Aditya Control room	1	5000 cfm	Weathermake	WH-3 with KEC TEFC/5 Hp/4P motor	As mentioned above
	vii) Room no.37, FFL of main bldg.	1	6400cfm	Batliboi	AHU-6 with TEFC/7.5 Hp/4P motor	As mentioned above
f.	Fan Coil units	53	2 TR	Batliboi	Horizontal	Side throw, 1/12 hp/ 3-speed motor, selector switch, prefilters, isolation valves at Inlet/Outlet of chilled water line, drain line/drain tray etc.
g.	Cooling Towers	2 (1W + 1S)	350 TR	Advance	A Series	FRP induced draft type, 114 CM/Hr with belt driven 10 hp/ SIEMENS/ 1450 rpm fan motor including float valves, isolation valves, sprinklers, fills etc.
h.	Insulated Chilled water and cooling water MS piping	Lot				This covers entire Interconnected water piping between above listed all equipments like chillers,

						condensers, AHUs', FCUs', pumps, CTs', heat exchangers, expansion tank, etc. Also, this will cover all necessary fittings, instruments and controls mounted in the piping like Gate, Globe Butterfly, Balancing valves, NRVs', Pot strainers, Y-strainers, pressure and temperature Gauges, Pressure and temperature transmitters, purge valves, vent valve, flow switches, modulating valves, float valves, expansion tank and its connected valves. etc. fitted in the piping of the plants.
i.	Main Electrical MCC Panel	1				Electrical panel with 800 amps drawn-out type incomer TPN ACB. This Panel accommodates feeders of 3 Nos. 125 TR Compressors Motors, 8 Nos. Water Pumps, 2 Nos. Cooling Tower Fan Motors, spare feeders, annunciation cum indication panel, with all electrical, mechanical & electronic, parts/controls and other accessories installed, with all internal/external wiring (control, power and earthing) for all of above equipments/items concerned.
2.	TBAC Plant Location: Tokamak Basement Plant Room					
a.	Chiller Package Units and ancillaries	2	100 TR	Blue Star		For comfort Air-conditioning and cooling of Aditya and LVPD experimental devices.
	i) Compressor	2	100 TR	Kirloskar	AC 1270	R-22 based reciprocating type compressors with drive package.

	ii) Condenser	2	100 TR	Blue Star	CDS-41305	Shell and Tube type
	iii) Chiller (Evaporator)	2	100 TR	Blue Star	YCH101	Shell and Tube type
	iv) Motor for comp.	2	120 hp	Sidemen's	200L	SPDP/3P/1500 rpm/star delta starter with drive packages.
	v) Refrigerant piping	2 set				This includes shut off valves, drier, filters, site glass and copper piping with gauge panel boards.
b.	Controls 2 sets					
	i) Expansion valves	4	52 TR	Sporlan		
	ii) RSV	2		Sporlan	P-180	
	iii) HP/LP Cut outs	2		Indfoss	MP-15	
	iv) OSS	2		Indfoss	MP-55	
	v) Operating Thermostat	6		Honeywell	T678A	2 nos. with USV and 1 no with RSV in each plant
	vi) AFT	2		Honeywell		
	vii) Refrigerant pres. gauges	6				HP-2 nos, LP-2 nos, OP-2 nos,
	viii) Condenser & Chiller diff. Press. Switches	4		Indfoss	IPSD-50	
	ix) Water press. Gauges	35		H. Guru / Fiebig		4" dial type
	x) Water temp. Gauges	24		H. Guru Fiebig		Stem type / Dial type
	xi) USV	6				3 nos. in each plant for loading and unloading of compressor.
	xii) Conductivity, pH meter	2 Nos				
	xii) CCH	2	200 Watts			1 no. in each compressor
c.	Chiller Pumps	3 (2W + 1S)	15 HP	Beacon	3DM8	Monoblock pumps/ 3 Q/2900 rpm
d.	Cooling water pumps	3 (2W + 1S)	25 HP	KBL	3UPIM15	Split casing type with TEFC motor, drive package.
e.	Cooling Towers	2	125 TR	Paharpur	1868P	FRP, induced draft type, 114 CM/Hr with 10 hp/TEFC/750 rpm ABC fan motor.
f.	Insulated Chilled water and un-insulated	Lot				This covers entire Interconnected water piping between above

	cooling water MS piping					listed all equipments like chillers, condensers, AHUs', FCUs', pumps, experimental devices, CTs', heat exchangers etc. this will cover all necessary fittings and controls mounted in the piping like valves, strainers, pressure and temp. Gauges, purge valves, flow switches, modulating valves, float valves, expansion tank and its connected valves etc. fitted in the piping of the plants.
g.	Main Electrical panel	1			Floor mounted type	Electrical panel with incomer 400 amps MCCB. This panel accommodates feeders of 2 nos. Compressors Motors, 6 Nos. Water Pumps, 4 Nos. Cooling Tower Fan Motors, and 4 nos. D.M. Water pumps, 2 nos. raw water pumps, annunciation cum indication panel, with all electrical, mechanical & electronic, parts/controls and other accessories installed, with all internal/external wiring (control, power and earthing) for all of above equipments/items concerned.
3.	SST1 Air conditioning Plant Location: MEL Basement					
a.	Screw type, skid mounted water Chiller Package units with in house safety controls, sensors, gauges and Auto loading /unloading devices	3 (2W + 1S)	125 TR	Dunham Bush (02 nos.) / Daikin (01 no.)	WCFX15E1D1C (Dunham Bush)/ PFS13510BRY (Daikin)	For comfort Air-conditioning of SST1 Building. Which includes Tokamak Hall, R.F. & NBI bay, control room and Diagnostic halls. Note: This plant can be also run as an alternate for the cooling of cryogenic experimental

	consists of following equipments:					devices in addition to the Air-conditioning. Note: 02 nos. of Dunham Bush make Screw Chillers may be replaced with new chillers in about 01 year.
	i) Compressor	3	125 TR	Dunham Bush / Daikin		R-22 (Dunham Bush)/ R134a (Daikin) based screw type hermetically sealed (Dunham Bush)/ Semi-hermetic (Daikin) compressors with instruments and controls like pressure transducers, temperature controller and sensors, motorized valve for loading unloading, photo sensor, crankcase heater, refrigerant level sensor etc.
	ii) Condenser	3	125 TR	Dunham Bush/ Daikin		Shell and Tube type
	iii) Chiller (Evaporator)	3	125 TR	Dunham Bush/ Daikin		Flooded type
	iv) Motor for comp.	3	83 KW	Dunham Bush/ Daikin		Refrigerant cooled motor mounted on compressor shaft with gear Mechanism.
	v) Micro processor Panel	3		Dunham Bush/ Daikin		This panel gives the status of chilling machine with LCD display and houses the soft starter and other Power / control contactors and electronic controls/circuits. This panel is mounted on each chilling machine.
b.	Chiller Pumps	3 (2W + 1S)	25 HP	Beacon	BWP 100/400	Back pull out pumps with KEC make 25 HP/ 3 Ph/1500 rpm motor, drive package. Note: These 03 nos. of Beacon make Chiller Pumps may be replaced with new Chiller pumps in about 01 year.
c.	Cooling water pumps	3 (2W + 1S)	15 HP	Beacon	BWP 80/260	Back pull out pumps with KEC make 15 HP/ 3 Ph/1500 rpm motor, drive package Note: 03 nos. of Beacon make Condenser water Pumps may be

						replaced with new Cooling water pumps in about 01 year.
d.	D.M. Water Pumps for Cryogenic experimental devices	2	25 HP	KBL		Pump with 25 hp/TEFC/4P motor, coupled type, The pump will circulate D.M. water to the experimental device for cooling purpose through 1250 KW PHE. This pump is primary side cooling pump. Note: This system works as a standby unit to the main cooling system for Cryogenic. This will work in conjunction with Screw chilling plant at partial load.
e.	Air Handling Units					
	i) MEL area	1	19860cfm	Ethos	Double skin type	With drive package, metallic pre-filters, 3 way diverting valve, isolations valves and thermostat with control panel. Insulated Ducting, canvass, and grilles, fresh air filters, dampers, electrical limit switch operated fire dampers and fire alarming panel with ionization type smoke detector with KEC make TEFC/ 15 Hp / 4P motor.
	ii) Diagnostic Lab.	1	10000 cfm	Ethos	Double skin type	As per mentioned above but with 10 HP motor
	iii) Central Control Room	1	15350 cfm	Ethos	Double skin type	As per mentioned above but with 10 HP motor. This unit also has 16 nos. Dyna make bag type micro filters of 1 micron.
	iv) N.B.I. First floor	1	14000 cfm	Ethos	Double skin type	As per mentioned above but with 10 HP motor
	v) Tokamak Basement	1	8950 cfm	Ethos	Double skin type	As per mentioned above but with 10 HP motor
	vi) R.F. First floor	1	17000 cfm	Ethos	Double skin type	As per mentioned above but with 15 HP motor
	vii) Tokamak Hall	1	19000 cfm	Ethos	Double skin type	As per mentioned above but with 15 HP motor
f.	Cooling Towers	2	150 TR	Paharpur	3870	FRP, induced draft type with 7.5 HP/3 Ph/900

						rpm motor of ABB make and belt drive package, float valve, drain, quick fill arrangements. Note: These 02 nos. of Paharpur make cooling towers may be replaced with 03 nos. (2W + 1S) new Cooling towers in about 01 year.
g.	Insulated Chilled water and cooling water MS piping	Lot				This covers entire interconnected water piping between above listed all equipments like chillers, condensers, AHUs', pumps, CTs', heat exchangers etc.. Also, this will cover all necessary fittings and controls mounted in the piping like Gate & Globe valves, NRVs', BFVs', Balancing valves, Pot strainers, Y-strainers, pressure and temp. Gauges purge valves, flow switches, modulating valves, float valves, expansion tank and its connected valves. etc. fitted in the piping of the plants.
h.	Electrical Panels for above utilities:					
	i) Main Electrical Panel	1			Floor mounted type	Main Electrical panel comprising of 800 amp MCCB in main incoming feeder and 3 x 400 amp MCCB for screw chiller packages main supply along with 6 feeders for chilled / condenser water circulation pumps and 2 feeders for cooling tower fan motors., 2 for cryogenic D.M. Water pumps with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling). Note: This main electrical panel may be replaced with

						new electrical panel in about 01 year.
	ii) Status indication panel	1			Floor mounted type	This indicates the status of screw chiller packages, pumps, AHUs' with remote ON/OFF facilities with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling).
	iii) Local Control panel for AHUs'	7			Wall mounted type	Starter panel for AHU motor with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
4.	Air Cooled Package units for Administration and Purchase section	2	7.5 TR	Fedders Lloyd	P25EK99	<p>Package units consists of Sealed compressors, Air cooled condensers, cooling coil, blower unit, drive package, pre filters, interconnected refrigerant piping with safety/controls, electrical panel with power & control wiring and earthling. S.A/R.A ducts, grilles, insulation, canvass connections.</p> <p>Note: Each Package has 2 circuits of 3.75 TR with 2 nos. sealed compressors. This includes the main electrical panel with 100 amps incomer MCB and different feeders for each unit.</p>
5.	Air Washer System for He-Compressor plant room	1	40000 CFM	ACCEL	Fan Model: CF-42 DIDW	A complete set of centrifugal blower with 30HP motor, belt drive package, fresh air filters, evaporative cooling cellulose pads, SS water tank, 2 nos. of water circulating pumps, ducting, grilles, fire

						dampers with limit switch, ionized type smoke detector with fire alarm panel and wall mounted electrical panels houses the feeder for the motor with all electrical, mechanical & electronic, parts/controls and other accessories installed inside the panel, with all internal/external wiring (control, power and earthing)
6.	Air Washer and Scrubber Unit (Kitchen Exhaust) for canteen, IPR					
	i) Air Scrubber (Kitchen Exhaust) Unit	1	15000 cfm	Citizen		With drive package Double skin scrubber (Kitchen exhaust) unit with water spray nozzle, filter, strainer, eliminator, SS kitchen hoods with accessories, damper. This includes insulated ducting, pre-filters, water tank, float valve, 2 HP pump and connected water piping and necessary valves/fittings/strainer etc.
	ii) Air Washer Unit	1	13500 cfm	Citizen		With drive package Double skin air washer unit with fills, water spray nozzle, filter, strainer, eliminator, with accessories. This includes insulated ducting, damper, pre-filters, water tank, float valve, 2 HP pump and connected water piping and necessary valves/fittings/strainer etc.
	iii) Electric panel	1				This is the main electrical panel with incomer TPN MCCB, DOL/ Star-delta starters for air washer, kitchen exhaust unit and associated pumps as mentioned above with indication panel, all electrical, mechanical &

						electronic, parts/controls and other accessories installed inside the panel, with all internal/external wiring/ cabling (control, power and earthling).
7.	Dx type Centralize air conditioning system at canteen, IPR					
a.	Air Handling Units (AHU)	01	25.5 TR, 8000 CFM	Zeco		With drive package, pre-filters, multi circuit cooling coil, expansion valve and thermostat. Insulated Ducting, SA damper, canvass, grilles, fresh air filters & dampers, fusible link type fire damper.
b.	Condensing Units	03	8.5TR	Carrier		Condensing units consists refrigerant circuits with Scroll compressor, Air-cooled condensers, Service valves, HP/LP switches, microprocessor based internal control panel, Filter driers, other accessories and interconnected refrigerant piping to AHU with safety/controls, remote control for temperature adjustment, control panel with control wiring and earthling.
c.	Electrical Panel for Dx type AC system	01				This is the main electrical panel with incomer TPN MCCB, DOL/ Star-delta starters, MCBs for AHU, various Condensing Units with indication panel, all electrical, mechanical & electronic, parts/controls and other accessories installed inside the panel, with all internal/external wiring/ cabling (control, power and earthling).
d.	Control Panel for Dx type AC system	01				This is the main PLC based control panel for AHU and Condensing Units with indication panel to control the temperature, run time equalizer etc and remote operation push switch. This includes all electrical, mechanical & electronic, parts/controls and other accessories installed inside the panel, with all

						internal/external wiring/cabling (control and earthing).
8.	Ductable Split ACs for Canteen at IPR					
a.	Ductable Split AC for canteen at IPR	02	5.5 TR	Carrier		2 nos. indoor unit, 2 nos. outdoor unit with single circuit condensing unit consists of Scroll compressor, Air-cooled condenser, Service valves, HP/LP switches, Filter drier, canvas connection, ducting, dampers, grills and other accessories and interconnected refrigerant piping to Indoor unit with safety/controls, remote control for temperature adjustment, electrical panel with power & control wiring and earthing.
9.	D.M. Water Cooling Plants for various Cooling Systems Location: TBAC Plant room					
a.	Cation-Anion Unit	1	6 CMPH	Ion Exchange	CA-600	<p>This unit generates D.M. water of <30 micro-S, which is used through M.B. Unit to the various experimental devices as a secondary cooling media. This includes all interconnected piping, valves, Degasser, air blower and Neutralizing pumps, instruments like rotameter, conductivity meter, sensors, gauges and necessary controls etc, with up flow filter</p> <p>Note: The operation, maintenance and regeneration with required quantity of chemical will be in the scope of the successful AMC contractor. Resin</p>

						replacement will be in IPR scope if needed.
b.	Mixed Bed Unit	1	40 CMPH	Ion Exchange	MB-1000	<p>This unit maintains the conductivity of D.M. water <1micro-S. The water coming from Cation- Anion unit is circulated through Mixed Bed unit before passing to various experimental devices. This includes all interconnected piping, valves, instruments like rotameter, conductivity meter, pH meter, sensors, gauges and necessary controls etc.</p> <p>Note: The operation, maintenance and regeneration with required quantity of chemical will be in the scope of the successful AMC contractor.</p> <p>The resin replacement of the unit shall be carried out by IPR as and when required.</p>
c.	Raw water Pump	2 (1W + 1S)	2 HP			With coupled motor. These are meant for feeding water to the inlet of Cation-Anion unit. This will include interconnected piping, valves, gauges etc.
d.	D.M. Water Pumps for LVPD experimental devices with PHE	2 (1W + 1S)	15 HP	Johnson		Pump with 15-hp/TEFC/4P motor, coupled type, The pump will circulate D.M. water from storage tank to the experimental device for cooling purpose through 240 KW PHE.
e.	DM Water Pumps for Aditya	2 (1W)	3 HP	Flowchem		BPO (Back Pull Out) type centrifugal pump, 180 lpm @ 25 m head.

	Experimental devices with PHE	+ 1S)				The pump will circulate D.M. water from storage tank to the experimental device for cooling purpose through 13 KW PHE. This pump is primary side cooling pump.
f.	DM Water Pumps for Basic lab Experimental devices with PHE	2 (1W + 1S)	7.5 HP	CRI		Vertical mono block centrifugal pump, 265 lpm @ 58 m head. The pump will circulate D.M. water from storage tank to the experimental device for cooling purpose through 50 kW PHE. This pump is primary side cooling pump.
g.	DM Make up water pumps	1	3 HP	Johnson	CCR 25-160	These are used for make- up of D.M. water Make up tank. These pumps are coupled type with 3 HP motor and drives set.
h.	Drain water pump	1	2 HP	Beacon	1-1/2 DM6 LD162	This is Monoblock type pump and is used to drain out water from the pit at TBAC plant.
i.	D.M. Water storage tank for Aditya and LVPD- Cryogenic experimental devices.	1	45000 Liters		Made out of SS sheet, cubical type	This tank has a partition in to two. 15000 liters for Aditya and 30,000 liters for LVPD & Cryogenic D.M. Water Storage.
j.	D.M. Make up tank for Aditya D.M. water storage tank	1	2000 liters		Made out of SS sheet, cubical type	This is used for the make up of Aditya storage tank. This shall include all necessary fittings, valves, glass indicator with inter connected SS piping.
k.	D.M. Make up tank for R.F experiments' D.M. Water storage tank	1	1000 liters		Made out of SS sheet, cubical type	This is used for the make-up of D.M. water storage tank made for R.F experimental devices. This includes all necessary fittings, valves; Digital Level indicator with inters connected SS piping.
l.	D.M. water and cooling water SS & MS piping	Lot				This covers entire Interconnected water piping between above listed all equipments like CTs', heat exchangers,

						<p>experimental devices etc. This will cover all necessary fittings and controls mounted in the piping like valves, strainers, pressure and temp. gauges, purge valves, flow switches, Pressure regulating valves, float valves, etc. fitted in the piping of the plants.</p> <p>Note: This includes SS piping, fittings, valves, and flow meters with display units, temperature and press. Gauges fitted in the DM water circulation system meant for LVPD, Aditya and Cryogenic cooling systems</p>
10.	Chiller Package units for SST-1 Vacuum system experiments					Location: Nr. SST-1 ECRH
a.	Chiller Package Unit (Industrial Water Cooler type) consists of following equipments:	1	9TR	Razvi		<p>For cooling of SST-1 Vacuum system experiments. Evaporative tube embedded SS storage tank of 750 Ltrs, R 22 refrigerant. This also includes 200 Watts CCH, shut off valves, drier, filters, site glass, expansion valve and copper piping with gauge panel boards.</p> <p>Note: Package unit is having twin's individual circuit of 4.5 TR.</p>
	i) Compressor	2	5 TR	Kirloskar-	AG series	R-22 based sealed reciprocating type compressor.
b.	Controls					
	i) Expansion valves	2	5 TR	Danfoss		
	ii) HP/LP Cut outs	2		Honeywell controls	YK 306	
	iii) Digital Temperature transmitter	1				

c.	Process Water Pumps	2 (1W + 1S)	1 HP	Flowchem	PPM 25/125	All are Monoblock pumps. (1W+1S)
d.	Chilled water insulated piping	1	Lot			This covers entire interconnected water SS piping between above listed all equipments like chillers, pumps, experimental devices etc. Also, this will cover all necessary fittings and controls mounted in the piping like NRVs', BLVs', Y-strainers, pressure and temp. Gauges purge valves, flow switches, fitted in the piping of the system
e.	Local Control panel for Plant	1	No		Floor mounted type	Starter panel for above three plant with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel and in SST1 hall, with all internal/external wiring (control, power and earthing)
11.	Soft Water Plant at Pump House Location: Pump House					
a.	Soft water plant	2 (1W + 1S)	30 CMPH	Doshion		It generates soft water, which is circulated through cooling water lines to the various A.C. Plants and WCS plants. This includes entire interconnected piping, valves, tanks, instruments, gauges, level indicators in the tanks regenerates, hardness testing kit and consumables for regeneration. Note: The operation, maintenance and regeneration of the soft water plants including supply of salt for regeneration will be in the scope of the successful AMC contractor. Approx. 1 to 2 regeneration of each plant will require in a

						month. The resin replacement of the unit shall be carried out by IPR as and when required.
b.	Raw water Pumps	5 (3W +2S)	30 CMPH	Mather + Platt	Back pullout	The pump feeds water from raw/Fire water tank to soft water plant. Connected with 10 HP/4P/ABB motor, interconnected water piping, valves, NRVs', strainers, gauges etc.
c.	Soft Water Pumps	2 (1W + 1S)	60 CMPH	Mather + Platt	Back pullout	The pump feeds water from soft water tank to overhead RCC tank. Connected with 15 KW/4P/Siemens motor, interconnected water piping, valves, NRVs', strainers, gauges etc.
d.	Drain Pump	1				The submersible pump of 1 HP for drain the water from water pit in the pump house
e.	Soft Water MS/ GI piping	Lot				This covers entire interconnected water piping between above listed pumps, storage and raw water tanks and Soft water plant etc. Also, this will cover all necessary fittings and controls mounted in the piping like Gate & Globe valves, NRVs', BFVs', strainers, pressure and temp. Gauges purge valves, flow switches etc. fitted in the piping of the plants.
f.	Local Control panel	1			Floor mounted type	Starter panel for 5 nos. raw water, 2 nos. soft water pumps and one submersible pump motors with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, level sensor & switch, power and earthling)
g.	Status indication panel	1			Floor mounted type	This indicates the status of raw water and soft water pumps and the level of soft water, over head tanks with

						remote ON/OFF facilities with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, level sensor & switch, power and earthing)
12.	R.F. Water Cooling systems for various RF & other experimental system Location of plant: MEL Basement & TBAC Plant room					
	D.M. Water cooling system for R.F. lab. Various experimental set ups like (ICRH, ECRH, Upper and lower body systems)	1 set	240 KW			Note: The operating and maintaining of the system will be in the scope of the successful AMC contractor. IPR will coordinate with Operation Supervisor of successful tenderer for operation of RF Cooling system.
a.	D.M. Water pumps	2 (1W + 1S)	2.2 KW	Johnson	CCR 32-160 R6M2L3	This is for the circulation of D.M. water through Mixed Bed unit to D.M. Water storage tank. Pump is with 3 HP/4P motor, drive packages.
b.	D.M. Water pump	1	10 HP	Johnson	CCR50-200 R6M2L3	This is for the circulation of D.M. water through Mixed Bed unit to D.M. Water storage tank. Pump is with 10 HP/4P motor, drive packages.
c.	D.M. Water pumps	2 (1W + 1S)	30 HP	Johnson	CCR 65-200 R6M2L3	This is for the circulation of D.M. water from storage tank to various R.F. experimental set ups through PHE. Pump is with 30 HP/4P motor, drive packages.
d.	D.M. Water pumps with single VFD unit with PHE	2 (1W + 1S)	60 HP	Johnson	CCR 80-250 R6M2L3	This is for the circulation of D.M. water from storage tank to various R.F. experimental set ups through PHE. Pump is with 60 HP/4P motor, drive packages and operated through Variable Speed Drive unit from 0 to 50 Hz frequency to control the

						flow across various exp. devices.
e.	S.S Water Piping	1 lot				This includes all interconnected SS piping between pumps, tanks, PHE, and various experimental set ups along with all necessary fittings, valves like BFVs', NRVs', strainers, Breathing valve, pressure safety valve, flow meter with display unit, level sensor with display, and sensors, rotameter, pressure and temperature gauges etc.
f.	Cooling Towers	2	125 TR	Paharpur	1868P	FRP, induced draft type, 114 CM/Hr with 10 hp/TEFC/750 rpm ABC fan motor.
g.	Cooling water pumps	2 (1W + 1S)	11 KW	Cromp. & Greaves	MBR 15.2 D	These are Monoblock type pumps required to circulate cooling water as a primary media through PHE to cool down the D.M. water. This includes the entire interconnected M.S. piping between cooling towers and PHE along with all necessary fittings and controls mounted in the piping like Gate & Globe valves, NRVs', BFVs', Pot strainers, Y-strainers, pressure and temp. Gauges purge valves; float valves, etc. fitted in the piping of the plants.
h.	Drain water Pump	2 (1W + 1S)	2 HP	KBL	SP-1MM	This is Monoblock type pump and is used to drain out water from the pit of D.M. Water Pumps.
i.	Mixed Bed Unit	1	15 CMPH	Ion-Exchange	MB-600	This unit is used to maintain the conductivity of D.M. water < 1 mS. This unit includes Air blower, resin tank, interconnected rubber lined piping, valves/fittings, Digital conductivity indicator,

						<p>sensors, level indicator, rotameter etc.</p> <p>Note: The operation, maintenance and regeneration with required quantity of chemical will be in the scope of the successful AMC contractor. The resin replacement of the unit shall be carried out by IPR as and when required.</p>
j.	De-Oxygenation unit	1	15 CMPH	Ion-Exchange	350CM	<p>This unit is used to maintain the oxygen content of D.M. water < 0.5 ppm which is required to be circulated through some experimental set ups This unit includes the main tank with interconnected piping, valves/fittings, Digital indicator, sensors, rotameter , motorized stirrer etc.</p> <p>Note: The operation, maintenance and regeneration with required quantity of chemical will be in the scope of the successful AMC contractor. The resin replacement of the unit shall be carried out by IPR as and when required.</p>
k.	Electrical panel for above plant	1				<p>This is the main electrical panel with incomer as 250 amps MCCB and feeders for various D.M.Water pumps listed above with annunciation cum indication panel, all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthing)</p>
13.	Chiller Package Unit for Beta Lab Experimental Device Location: Near Beta Lab.					

a.	Chiller Package Unit consists of following equipments:	1	7.5 TR	Voltas		For cooling of Beta Lab. Experimental device
	i) Compressor	2 (1W + 1S)	7.5 TR	Voltas	06D024	R-22 based semi-sealed, reciprocating type compressors. 1 compressor acts as a stand by unit. With refrigerant cooled sealed motor 11.25 KW.
	ii) Condenser	1	7.5 TR	Voltas	9 ABB	Air cooled tube and fins type
	iii) Chiller (Evaporator)	1	7.5 TR	PAT	DX	Shell and Tube type
	iv) Refrigerant piping	1set				This includes shut off valves, drier, filters, site glass and copper piping with gauge panel boards.
b.	Controls					
	i) Expansion valves	1	7.5 TR	Sporlan	TEV05	
	ii) HP/LP Cut outs	1		Indfoss	MP-15	
	iii) OSS	1		Indfoss	MP-55	
	iv) Operating Thermostat	1		Honeywell	T678A	
	v) AFT	1		Honeywell		
	vi) Refrigerant pres. gauges	4		H. Guru/ Fiebig		HP-2 nos, LP-2 nos,
	vii) Chiller diff. Press. Switches	1		Indfoss	IPSD-50	
	viii) Water press. Gauges	2		H. Guru/ Fiebig		4" dial type
	ix) Water temp. Gauges	1		Fiebig		Stem type
	x) USV	2				1 no. In each compressor
	xi) CCH	2	40 Watts			1 no. In each compressor
c.	Chilled Water Pumps	4 (2W + 2S)	2 HP	Beacon	1-1/2 DM6-LD	All are Monoblock pumps. 2 are for primary chilled water circuit and 2 nos. are for secondary Water-cooling circuits.
d.	Chilled Water Storage Tank	1	1000 liters	Sintex	Cylindrical type	Insulated chilled water tank for the storage purpose
e.	Chilled water insulated piping	1	Lot			This covers entire interconnected water piping between above listed all equipments

						like chillers,, pumps, , experimental devices etc.. Also, this will cover all necessary fittings and controls mounted in the piping like NRVs', BFVs', Y-strainers, pressure and temp. Gauges purge valves, flow switches, fitted in the piping of the plants.
f.	Local Control panel for Plant	1	No		Floor mounted type	Starter panel for above plant with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
14.	Chiller Package units for First face wall experiment & LVPD experiment Location: Outside of MEL Lab. & Nr. Utility building.					
a.	Chiller Package Unit (Industrial Water Cooler type) consists of following equipments:	2	9TR	Razvi		For cooling of LVPD, First face wall Experimental devices and ECRH System. Evaporative tube embedded SS storage tank of 750 Ltrs, R 22 refrigerant. This also includes 200 Watts CCH, shut off valves, drier, filters, site glass, expansion valve and copper piping with gauge panel boards. Note: Each package unit is having twin's individual circuit of 4.5 TR.
	i) Compressor	4	5 TR	Kirloskar-	AG series	R-22 based sealed reciprocating type compressor.
b.	Controls					
	i) Expansion valves	4	5 TR	Danfoss		
	ii) HP/LP Cut outs	4		Honeywell controls	YK 306	

	iii) Digital Temperature transmitter	2				
c.	Chilled Water Pumps for LVPD & First Wall System	3	1 HP	CG	2850 rpm	All are Monoblock pumps.
d.	Chilled water insulated piping	2	Lot			This covers entire interconnected water piping between above listed all equipments like chillers, pumps, experimental devices etc.. Also, this will cover all necessary fittings and controls mounted in the piping like NRVs', BFVs', Y-strainers, pressure and temp. Gauges purge valves, flow switches, fitted in the piping of the all three plants (First face wall experiment & LVPD experiment Device)
e.	Local Control panel for Plant	2	No		Floor mounted type	Starter panel for above three plants with all electrical, mechanical & electronic, parts/controls and other accessories installed in the panel with all internal/external wiring (control, power and earthing)
15.	Chiller Package unit for Vacuum Furnace experiment Device Location: Outside of Pump House					
a.	Chiller Package Unit (Industrial Water Cooler type) consists of following equipments:	1	10 TR	Air Tech Engineers		
	i) Compressor	1	10 TR	Copeland	Model-ZR12M3-TWD-551	R-22 based sealed scroll type compressor.
	ii) Condenser	1				Air cooled tube and fins type
	iii) PHE (SS Plate type heat exchanger)	1			DX	This PHE installed in chiller package and connected to in build tank is having capacity of 200 liters water storage.

	iv) Refrigerant piping	1 set				This includes shut off valves, drier, filters, site glass and copper piping with gauge panel boards.
	v) Condenser fan motor	3		CG	410 W	This includes the fan blade and motors.
b.	Controls					
	i) Expansion valves	1	10 TR			
	ii) HP/LP Cut outs	1				
	iii) Digital Temperature transmitter	1				
	iv) Refrigerant pres. gauges	2		H. Guru / Fiebig		HP-1 nos, LP-1 nos,
	v) Chiller diff. Press. Switches	1				
	vi) Water press. Gauges	3		H. Guru/ Fiebig		4" dial type
	xii) CCH (Heater)	1				
c.	Chilled Water Pumps	1	5 HP	KBL		Mono block pumps.
d.	Chilled water insulated piping	1	Lot			This covers entire interconnected water piping between above listed all equipments like Tank, pumps, PHE and experimental devices etc.. Also, this will cover all necessary fittings and controls mounted in the piping like NRVs', BFVs', 3 way diverting valves, solenoide valves, Y-strainers, pressure and temp. Gauges, purge valves, flow switches, fitted in the piping of the plant.
e.	Local Control panel for Plant	1	No		Inbuilt	Starter panel for above plant with all electrical, mechanical & electronic, parts/controls and other accessories installed in the package with all internal/external wiring (control, power and earthing)
16.	Chiller Package unit for LASER experiment Device Location: Outside Laser Lab, SST1 Building					

a.	Chiller Package Unit (Industrial Water Cooler type) consists of following equipments:	1	15 TR	Air Tech Engineers		For cooling of LASER experiment Device.
	i) Compressor	3	5 TR	Kirloskar	Model-KCG-562 HAE	R-22 based sealed reciprocating type compressor.
	ii) Condenser	1				Air cooled tube and fins type
	iii) PHE (SS Plate type heat exchanger)	3			DX	This PHE installed in chiller package and connected to in build tank is having capacity of 200 liters water storage.
	iv) Refrigerant piping	3 set				This includes shut off valves, drier, filters, site glass and copper piping with gauge panel boards.
	v) Condenser fan motor	4		CG	410 W	This includes the fan blade and motors.
b.	Controls					
	i) Expansion valves	3	5 TR			
	ii) HP/LP Cut outs	3				
	iii) Digital Temperature transmitter	1				
	iv) Refrigerant pres. gauges	6		H. Guru / Fiebig		HP-3 nos, LP-3 nos,
	v) Chiller diff. Press. Switches	3				
	vi) Water press. Gauges	3		H. Guru/ Fiebig		4" dial type
	xii) CCH	3				1 no. In each compressor
c.	Chilled Water Pumps	1	3 HP	Grundfos		Mono block pumps.
d.	Chilled water insulated piping	1	Lot			This covers entire interconnected water piping between above listed all equipments like Tank, pumps, PHE and experimental devices etc.. Also, this will cover all necessary fittings and controls mounted in the piping like NRVs', BFVs', Y-strainers, pressure and

						temp. Gauges, purge valves, flow switches, flow meter fitted in the piping of the plant.
e.	Local Control panel for Plant	1	No		Inbuilt	Starter panel for above plant with all electrical, mechanical & electronic, parts/controls and other accessories installed in the package with all internal/external wiring (control, power and earthing)
17.	Chiller Package unit for LASER experiment Device Location: Terrace of MEL Lab					
	Chiller Package Unit (Industrial Water Cooler type) for LASER device.	1	15 TR			For cooling of LASER experiment Device. Skid based three circuit of Danfoss make 5 TR capacity with R22 refrigerant, 02 nos. of Flowmatics make 0.5 HP Water process pump of flow capacity 33 lpm @1.5 bar, control panel, temperature controller, storage tank, condensing coils, condenser fans etc.
18.	Chiller Package units for DFD (Diverter and First wall Technology Development Division) Location: IPR and IPR-Extension lab, GIDC, Gandhinagar (One at each location).					
	Chiller Package Unit (Industrial Water Cooler type) for DFD system.	2	10 TR	Frigidaire Refrigeration		For cooling of DFD experimental Device. Skid based twin circuit of 5 TR x 2 capacity for each Industrial water cooler with R22 refrigerant, Water process pump of 20 lpm @7.8 bar, water circulating pump, control panel, temperature controller, SS storage tank, condensing coil, condenser fans etc.
19.	Chiller Package Unit for Plasma Torch Division Location:	1	10 TR	Weathberg		For cooling high power plasma torch components, experimental chamber and magnet coils. 5 TR

	FCIPT, GIDC, Gandhinagar					x 2 circuit compressor with R-22 refrigerant, Water process pump of 2 HP, 100 LPM @ 4 bar, 500 Lit storage tank. Control panel, Evaporator, Condenser, Electrical and safety controls, refrigeration controls, water circulation system with flow meter, chiller kit and with microprocessor control etc.
20.	Chiller Package Unit for Aditya Vacuum and Diagnostics	1	10 TR	Snowcool		For cooling Vacuum baking and diagnostics related components. 5 TR x 2 circuit compressor with R-407C refrigerant, Water process pump of 0.55 KW, 50 LPM @ 2.75 bar, Primary pump 0.75 KW, 100 LPM @ 1.8 bar, 500 Lit storage tank. Control panel, Evaporator, Condenser, Electrical and safety controls, refrigeration controls, water circulation system with flow meter, chiller kit and with microprocessor control etc.
21.	Chiller Package Unit for Plasma Torch Division and P SE Division, Location: FCIPT, GIDC, Gandhinagar	2	3 TR	Weathberg		For cooling low power plasma torch components, experimental chamber and magnet coils. With storage tank, water supply pump, microprocessor based controls, compressor, condenser and evaporator etc. Same chiller installed in PSE division for cooling experimental system components
22.	Chiller Package Unit for cryo cooler	2	5 TR	Refcon		For cooling cryo components. 3 TR + 2 TR twin circuit, With

	at IPR Extension Lab, Gandhinagar					storage tank 300 Litre, 1 HP 50 LPM water supply pump, microprocessor based controls, Refrigerant R-22, compressor, condenser and evaporator etc.
23.	Chiller Package Unit for Workshop Location: IPR	1	2 TR	Refcon		For water jet cutting machine in workshop
24.	Air Cooled Package unit for Computer Hall-Mezz. Floor	1	10 TR	Batliboi	BB1OAC5M	A package unit consists of 2 nos. individual 5 TR refrigerant circuits with 2 nos. Sealed compressors, Air-cooled condensers, cooling coil, blower unit, drive package, pre filters, and interconnected refrigerant piping with safety/controls, electrical panel with power & control wiring and earthing. S.A/R.A ducts, grilles, insulation, canvass, fire dampers, smoke detectors. This also includes a Main electrical panel with incomer SFU/MCCB.
25.	Air Cooled Package unit for R.F. Lab.- Ground & First Floor	1 1 2	10TR 15 TR 7.5 TR	Blue star	DPA-1202 DPA-1803 DPA-901	Package units consists of Sealed compressors, Air cooled condensers, cooling coil, blower unit, drive package, pre filters, interconnected refrigerant piping with safety/controls, electrical panel with power & control wiring and earthing. S.A/R.A ducts, grilles, insulation, canvass connections. Note: 10 TR Package has 2 circuits of 5TR with 2 nos. compressors, 15 TR Package has 3 circuits of 5 TR with 3 nos.

						sealed compressors, where as in 7.5 TR Package single circuit with single sealed compressor of 7.5 TR.
26.	Air Cooled Package unit for Admin Annexure	2	10 TR	Batliboi	A1000A2H5	As mentioned above. This also includes a Main electrical panel with incomer SFU/MCCB.
27.	Air Cooled Package unit for Negative NBI in Utility, FF	2	17 TR	Voltas	DPUASC170CD	Package unit consists of 2 nos. individual 8.5 TR refrigerant circuits with 2 nos. Sealed scrolled compressors, Air-cooled condensers, cooling coil, blower unit, drive package, pre filters, and interconnected refrigerant piping with safety/controls, inbuilt microprocessor control, electrical panel with power & control wiring and earthing. S.A ducts, grilles, insulation, canvass. This includes the main electrical panel with 125 amps incomer TP MCCB and different feeders for each unit.
28.	Air cooled Package unit for Control room of Aditya Hall (1W+1S)	2	11 TR	Voltas	DPUASC110	As mentioned above. This also includes a Main electrical panel with incomer SFU/MCCB, remote controller panel and junction box.
29.	Air Cooled Package unit for Seminar Hall, FCIPT, Gandhi nagar	2	11 TR	Voltas	DPUASC110	Package unit consists of 2 nos. individual 5.5 TR refrigerant circuits with 2 nos. Sealed scrolled compressors, Air-cooled condensers, cooling coil, blower unit, drive package, pre filters, and interconnected refrigerant piping with safety/controls, inbuilt microprocessor control, electrical panel with power & control wiring

						and earthing. S.A/RA ducts, fire damper, fresh air damper, grilles, duct insulation, canvass. This includes the main electrical panel with 100 amps incomer TP MCCB and different feeders for each unit.
30.	Air Cooled Package unit for IPR-Extension lab, GIDC, Gandhinagar	4	11 TR	Bluestar	DPA1322R1	As mentioned above. This also includes 02 nos. of main electrical panel with incomer MCCB for 04 Package AC.
31.	Ductable Split ACs for Guest House & Student Facilities at IPR					
a.	Ductable Split AC for Student Facility Building (For GF dining area)	01	7.5 TR (2.5TRx3 Circuit)	Hitachi		1 nos. indoor unit, 1 nos. outdoor unit Indoor unit (2.5TRx03 Circuit), condensing unit consists of 03 no. individual 2.5 TR refrigerant circuits with Scroll compressor, Air-cooled condenser, Service valves, HP/LP switches, Filter drier, canvas connection, ducting, dampers, grills and other accessories and interconnected refrigerant piping to Indoor unit with safety/controls, remote control for temperature adjustment, electrical panel with power & control wiring and earthing.
b.	Ductable Split AC for Student Facility Building, (For Gymnasium area)	01	5.5 TR	Hitachi		1 nos. indoor unit, 1 nos. outdoor unit and other details Details as per above
c.	Ductable Split AC for Student Facility Building (For Indoor Sports area)	01	5 TR (2.5TRx2 Circuit)	Hitachi		2 nos. indoor unit, 1 nos. outdoor unit and other details Details as per above
d.	Ductable Split AC for Guest House Building (GF Dinning & FF	02	5 TR (2.5TRx2 Circuit)	Hitachi		2 nos. indoor unit, 1 nos. outdoor unit and other details Details as per above.

	conference hall)					
32.	Ductable Split ACs for IPR-Extension lab, GIDC, Gandhinagar					
a.	Ductable Split AC for Labs in IPR-Extension Lab Building (GF and LIGO area)	02	8.5 TR	Carrier		1 nos. indoor unit, 1 nos. outdoor unit with single circuit condensing unit consists of Scroll compressor, Air-cooled condenser, Service valves, HP/LP switches, Filter drier, canvas connection, ducting, dampers, grills and other accessories and interconnected refrigerant piping to Indoor unit with safety/controls, remote control for temperature adjustment, electrical panel with power & control wiring and earthing.
b.	Ductable Split AC for Labs in IPR-Extension Lab Building (GF and LIGO area)	10	5.5 TR	Carrier		Details as per above
33.	VRV/ VRF Air Conditioning system for LHCD Lab					
a.	Condensing Unit (Outdoor unit)	02	12 HP TR	TOSHIBA		VRV/ VRF condensing (outdoor) units of 12 HP TOSHIBA make with hermetically sealed highly efficient Scroll Compressors, condenser coils, fans, inverter, microprocessor controller, interconnected refrigerant pipes, electric panel, control wires and power cables etc.
b.	Ductable Indoor Unit	02	8 TR	TOSHIBA		Ceiling mounted ductable unit of 8 TR cooling capacity, 3000 CFM@270 Pascal air flow with cooling coil, centrifugal fan, filter, EEV (Electronic expansion valve), corded remote controller, interconnected refrigerant pipes etc.
c.	Wall mounted indoor Unit	04	1.65 TR	TOSHIBA		Wall mounted indoor unit of 1.65 TR cooling

						capacity with cooling coil, blower motor, filter, cordless remote controller, EEV (Electronic expansion valve), interconnected refrigerant pipes etc.
d.	HRV unit for fresh air supply	01	203 CFM	TOSHIBA		HRV (Heat recovery ventilator) unit of 203 CFM @ 80% efficiency with fresh air blower, exhaust air blower, air to air non-flammable cross flow heat exchanger etc.
e.	Central remote control unit	01		TOSHIBA		Central remote control unit for controlling the all indoor units, outdoor units and HRV unit including interconnected control and power cables etc.
34.	Dx type Centralize air conditioning system for HVPS lab					
a.	Air Handling Units (AHU)	02	15 TR, 6000 CFM	Zeco		Double skin air handling unit, pre filter section, cooling coil sections with coils for Direct Expansion and with thermostatic expansion valve, fan assembly section with fan, Motor, Drive set, drain tray etc. Fan-motor assembly on common base frame with spring type vibration isolation. Suitable inspection doors for filter & blower sections. Other accessories like fire damper, canvas connection, ducting, dampers, grills with VCD etc.
b.	Condensing Units	04	8.5TR	Hitachi		4 Nos. outdoor unit with single circuit condensing unit consists of compressor, Air-cooled condenser, Service valves, HP/LP switches, Filter drier, and interconnected refrigerant piping to AHU unit with safety/controls etc.
c.	Electrical Panel for Dx type AC system	01				Electrical panel with power & control wiring and earthing.
d.	Control Panel for Dx type AC system	04				Controller for temperature

						adjustment, unit on off, time scheduling etc.
35.	Dx type Centralize air conditioning system for APPS lab					
a.	Air Handling Units (AHU)	01	25.5 TR, 8000 CFM	Citizen		Details as mentioned above in respective column.
b.	Condensing Units	03	8.5TR	Carrier		Details as mentioned above in respective column.
c.	Electrical Panel for Dx type AC system	01				Details as mentioned above in respective column.
d.	Control Panel for Dx type AC system	01				Details as mentioned above in respective column.
36.	Dx type Centralize air conditioning system for RHVPS lab					
a.	Air Handling Units (AHU)	01	34 TR, 13500 CFM	Citizen		Details as mentioned above in respective column.
b.	Condensing Units	04	8.5TR	Carrier		Details as mentioned above in respective column.
c.	Electrical Panel for Dx type AC system	01				Details as mentioned above in respective column.
d.	Control Panel for Dx type AC system	01				Details as mentioned above in respective column.
37.	Dx type Centralize air conditioning system for Neutronics lab					
a.	Air Handling Units (AHU)	01	17 TR X 2 nos. cooling coil (1W+1S) 7500 CFM	Zeco		Double skin air handling unit, pre filter section, cooling coil sections (2 Nos. coil, 1W + 1S) with coils for Direct Expansion and with thermostatic expansion valve, fan assembly section with fan, Motor, Drive set, drain tray etc. Fan-motor assembly on common base frame with spring type vibration isolation. Suitable inspection doors for filter & blower sections. Other accessories like fire damper, canvas connection, ducting, dampers, grills with VCD etc.
b.	Condensing Units	04	8.5TR (2W + 2S)	Carrier		4 Nos. outdoor unit (2W + 2S) with single circuit condensing unit consists of compressor, Air-cooled condenser, Service valves, HP/LP switches, Filter drier,

						and interconnected refrigerant piping to AHU unit with safety/controls,
c.	Electrical Panel for Dx type AC system	01				Electrical panel with power & control wiring and earthing.
d.	Control Panel for Dx type AC system	01				Controller for temperature adjustment, unit on off, time scheduling etc.
e.	Duct mounted heater	01	4.5 Kw	Khokhar		4.5 kw Electrical Re-heaters with Thyristor Based Power Controllers to modulate load from 0 to 100%, with Modulating Humidistat & Airstat/Geysersstat etc.
38. Dx type Centralize air conditioning system at FCIPT, GIDC, Gandhinagar						
a.	Air Handling Units (AHU)					
	i) Admin & Library Area	01	11 TR, 4400 CFM	Citizen		Details as mentioned above in respective column.
	ii) Staff area	01	17 TR, 6800 CFM	Citizen		Details as mentioned above in respective column.
	iii) Basic experimental Lab.	01	8.5 TR, 3400 CFM	Citizen		Details as mentioned above in respective column.
	iv) SPIX/ XPS Lab	01	8.5 TR, 3400 CFM	Citizen		Details as mentioned above in respective column.
b.	Condensing Units					
	i) For Admin & Library area AHU	02	5.5TR	Carrier		Details as mentioned above in respective column.
	ii) For Staff area AHU.	02	8.5 TR	Carrier		Details as mentioned above in respective column.
	iii) For Basic Experimental Lab. AHU.	01	8.5TR	Carrier		Details as mentioned above in respective column.
	iv) For SPIX/ SPX Lab AHU.	01	8.5TR	Carrier		Details as mentioned above in respective column.
c.	Electrical Panel for Dx type AC system	01				Details as mentioned above in respective column.
39.	Air Washer Unit for Workshop	1	18000 cfm	Citizen		With drive package Double skin air washer unit with fills, water spray nozzle, filter, strainer, eliminator,

						with accessories. This includes insulated ducting, damper, pre-filters, water tank, float valve, 2 nos. 1 HP pump and connected water piping and necessary valves/fittings/strainer etc.
40.	Ventilation Systems for various plant rooms / Utility Halls / Compressor Hall/other labs					
a.	Ventilation System for KBAC plant room	1	6000 cfm	PAT		This ventilation system is for the plant room only. This consists of one no. Centrifugal blower unit, 5 HP/ 4P motor with pre filters, S.A. insulated ducting, diffusers/grilles, canvass connection, 2 nos. exhaust fans of 1 HP with local control panel, power cabling/earthling.
b.	Ground Floor of Utility Building	2 sys	20000 cfm	Patel Airtemp	PB-84	A complete set of centrifugal blower with 10 HP motor, belt drive package, fresh air filters, ducting, grilles, fire dampers with limit switch, ionized type smoke detector with fire alarm panel and wall mounted electrical panel houses the feeder for the motor with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
c.	First Floor of Utility Building	2 sys	17500 cfm	Patel Airtemp	PB-84	As mentioned above
d.	Screw Chiller plant room	1 sys	11000 cfm	Patel Airtemp	PB-62	As mentioned above but with 7.5 HP motor.

e.	Air Exhaust Unit for Nitrogen Baking Plant Room	01	5000 cfm	Chauhan Engineering		A complete set of Single Skin Cabinet type exhaust air unit with 2 HP motor, belt drive package, ducting, grilles and wall mounted electrical distribution board and Star-Delta starter for the motor with all electrical, mechanical & electronic, parts/controls and other accessories.
f.	Air Exhaust Unit for Compressor hall	01	15000 cfm	Citizen		A complete set of Single Skin Cabinet type exhaust air unit with 5 HP motor, belt drive package, ducting, grilles and wall mounted electrical panel with all electrical, mechanical & electronic, parts/controls and other accessories.
g. Roof Extractors for exhaust						
	i) First floor of Utility Building	11	600mm dia	Patel Airtemp	DH-62	Fans are mounted at the terrace of Utility Bldg.
	ii) Cryogenic Hall	6	750 mm dia	Patel Airtemp	DH-75	Fans are mounted at the terrace of cryogenic Bldg.
h. Exhaust Fans						
	i) Ground Floor of Utility Building	27	300 mm dia	GEC Alstom	GPMN-38061	Used for the exhaust of entire hall
	ii) Screw Chiller Plant room	4	380 mm dia	GEC Alstom	GPN-45061	Used for the exhaust of the plant room
	iii) He-Compressor Plant room	10	4000 CFM	GEC	GPN-45061	For exhaust air from the plant.
	iv) SST Water Cooling Plant room	11	300 mm dia	GEC Alstom	GPMN-38061	For exhaust air from the plant.
	v) Nitrogen Baking Plant room	3	450 mm dia, 2500 CFM	GEC Alstom	GPMN-38061	For exhaust air from the plant.
	vi) Nitrogen Baking Plant room	1	300 mm dia, 720 cfm	GEC Alstom	GPMN-38061	For exhaust air from the plant.
i. Electrical Panels for above equipments						
	i) Local Control panel	7			Wall mounted type	Starter panel for Blower motor with all

	for Ventilation systems mentioned as item no. 14 A & 14 B					electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
	ii) Local Control panel for Ventilation systems mentioned as item no. 14 C	1			Wall mounted type	It houses feeders for fan motor including incomer SFU with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
	iii) Local Control panel for First floor of Utility Building	1			Floor mounted type	It houses feeders for 11 nos. roof extractors (of utility first floor) with all electrical, mechanical & electronic, parts/controls and other accessories installed in side the panel, with all internal/external wiring (control, power and earthling)
	iv) Local Control panel for Roof extractors Cryogenic Hall	1			Wall mounted type	It houses feeders for 6 nos. roof extractors (of Cryogenic Hall) with all electrical, mechanical & electronic, parts/controls and other accessories installed inside the panel, with all internal/external wiring (control, power and earthling)
41.	Kitchen exhaust unit for Guest House and Student Facility	2	6400 cfm	Ethos		A complete set of Single Skin Cabinet type Kitchen Exhaust Unit with 5 HP motor, belt drive package, ducting, SS Kitchen Hoods and wall mounted motor

						starter with all electrical, mechanical & electronic, parts/controls and other accessories.
42.	Cooling tower and CT pumps for HVPS System					
	i) Cooling Tower	1	170 TR	Mihir	CM 9/7.5D/5	Induced draft counter flow FRP cooling tower with all accessories.
	ii) CT fan motor	1	5 HP	Navyug		TEFC induction motor of 5 HP for cooling tower fan.
	iii) CT Pumps	2 (1W + 1S)	15 HP	Grundfoss		Back Pull Out pump with 15 HP motor of 1000 lpm @ 30 m head.
	IV) Electric Panel	1				Main electrical panel with incomer TPN MCCB, DOL/ Star-delta starters for CT fan and CT pumps and spare feeder with indication panel, all electrical, mechanical & electronic, parts/controls and other accessories installed inside the panel, with all internal/external wiring/ cabling (control, power and earthing).

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PLANTS MAINTENANCE SCHEDULE

(For equipments covered under item S. No. 1 to 42 as per Annexure-I.b)

1. COMPRESSOR:

a. OPEN / SEMI HERMETIC COMPRESSOR (SCREW/RECIPROCATING TYPE)

Daily:

- Cleaning
- Checking lubrication oil (level & leakage) and maintain the level by make up if any.
- Checking and recording the operating parameters

Monthly:

- Check condition and alignment of compressor drive set of open compressor.
- Lubricate motor bearings (quarterly)
- Check operation of safety controls, shut off valves / angle valves and instruments

Yearly:

- Inspect oil for discoloration or contamination after initial charges as per manufacturers
- The Lubricating oil to be change every year preferably during winter maintenance.

Repairs: The Seal assembly, Supply and discharge valves, Items involved in stoppage of refrigerant / oil leakages, Expansion valves can be repaired and made functional. If they are found not repairable, then need to be replaced by the contractor with new one.

Replacement of Items: The following items, if found faulty need to be replaced **by the contractor with new one** –

Suction valve spring, connecting rod, bearing inserts, main bearings, cylinder sleeves, various rings, gasket sets, O ring sets, aluminum packing set, suction disc, star washer, seal cover plate, DV disc, DV guide assembly, DV spring, valve plate, oil pump assembly, DV guide lock washer, piston pins, piston pin lock rings, Connecting rod assembly, regulating valve, oil filter, felt filters, various brass & thrust washers, loading / unloading fork with piston assembly, hydraulic relays, internal lubrication tubing, capacity control valve, belt, sight glass, etc. The cost of these items to be borne by the contractor.

b. HERMETIC COMPRESSOR (SCREW /SCROLL/ RECIPROCATING TYPE)

Daily:

- Cleaning
- Checking lubrication oil (level & leakage) and recharging
- Checking operating parameters

Monthly: Check operation of safety controls & instruments and

Yearly:

- Inspect oil for discoloration or contamination.
- The Lubricating oil to be change every 2 year preferably during winter maintenance.

Repairs: The Motorized valves can be repaired and made functional. If they are found not repairable, then need to be replaced **by the contractor** with new one.

Replacement of Items: The following items, if found faulty need to be replaced **by the contractor** with new one –

The Sight glass, solenoid valves, NRV etc.

Note:

1. In case of failure of sealed scroll/reciprocating compressor, the faulty compressor has to be replaced by new/factory-repaired compressor **by the contractor**. However, final acceptance of any repaired / replaced compressor by the contractor shall be decided by the designated engineer / Section Head/ Division Head / Project Leader after testing in the respective system at IPR. In case the original manufacturer do not exist or model is changed, then the other available compatible makes or model of the compressor shall be got approved from the concerned engineer or Section Head/ Division Head /Project Leader and installed at no extra cost.

2. Repairing of screw compressor will not be in the scope of contractor. However, necessary labour required to carrying out the work like dismantling faulty compressor from the skid, refitting the repaired compressor, pressure testing and re-commissioning the system after repairs with the supply of gas and oil shall be under the scope of contractor.

2. CONDENSER / EVAPORATOR OF ALL CENTRAL CHILLING PLANTS & COOLING COILS OF AHUs

Daily: Check entering and leaving water temperatures, refrigerant pressures and all others parameters.

Monthly: Check cooling tower water being circulated for the suspended particles, algae formation, if. Find so; refill the circuit with fresh water.

Yearly:

- Check tubes and if require, de-scaling shall be carried out by the contractor using special chemicals.
- Check pressure setting of safety control switches.
- Drain the chilled water and refill the water system with air purging
- Check for operation of safety valves.

Repairs: The following items can be repaired and made functional by the contractor. If they are found not repairable, then need to be replaced by the contractor.

- All types of valves including gate, butterfly, globe, ball, diverting, balancing, float, needle, angle, shut off valves etc.
- Welding/brazing of leakage points, minor leaks etc.

Replacement: The water box gaskets have to be replaced **by the contractor**, whenever head is opened for brushing / de-scaling.

Note: The replacement of damaged shell or body of the heat exchanger will not be in the scope of contractor.

3. ALL PUMPS (CONDENSOR, CHILLERS, PROCESS, WATER TREATMENT PLANT, ETC.)

Daily: Check gland packing and mechanical seals for leakage

Monthly:

- Check the alignment and conditions of coupling to prevent damage to shaft and impeller
- Lubricate bearings with grease gun.
- Replace gland thread/ mechanical seal if required
- Check lubricant oil level / make up the oil (in case of oil lubricated pumps)

Yearly:

- Inspect shaft, shaft sleeves, bearing, bearing housing etc.
- Over hauling of all pumps. At the time of overhauling, the damaged parts need to be replaced by the contractor

Repairs: The Impeller and shaft can be repaired and made functional. If they are found not repairable, then need to be replaced by new one by the contractor.

Replacement: The Packing, mechanical seal, bush, bearing, Shaft sleeves, coupling etc. if found faulty need to be replaced with new one **by the contractor**.

4. INSTRUMENTS & CONTROLS

- Monthly checking of operation of all controls, sensors, measuring devices, electronic control cards etc.
- Readjustment of control if necessary

Repairs: Motorized valves, flow meter with sensor & display, conductivity meter with sensor & display, pH meter with sensor & display, modulating valve with actuator, oxygen meter with sensor & display, rotameter can be repaired and made functional. If they are found beyond repairable, then need to be replaced by new one **by the contractor**.

Replacement: The items- Refrigerant level sensor, water level sensor, photo sensor, pressure transducer, thermostat, temperature controller with sensor and display, thermocouple, temperature gauge, sight glass, solenoid valves, pressure gauge, oil safety switch, HP/LP cut out, DP switch, flow switch, crank case heater, thermostatic expansion valve, thermostat (operating & antifreeze) smoke detector, air stat, safety valve, limit switch, humidistat, etc if found faulty need to be replaced with new one **by the contractor**.

5. REFRIGERANT PIPING:

Monthly: Check for leaks at the joints with soap solution test.

Yearly:

- Check valves for wear at the valve disc and seat.
- Check the insulation for breaks in the vapour barrier and other possible locations.

Repairs: Refrigerant piping can be repaired and made functional. If it is found beyond repairable, then need to be replaced by new one **by the contractor**.

Replacement: The items- check valves in Refrigerant piping, if found faulty need to be replaced with new one **by the contractor**.

6. WATER PIPING, VALVES & FITTINGS (MS & SS - BOTH ABOVE AND UNDER GROUND PIPINGS)

Daily: Check for leakages.

Monthly:

- Check for leaks at the joints.
- Check for leakage from valve glands.
- Clean Y-Strainers & pot strainers.

Yearly:

- Check for the damage in insulation
- Checks for the rusting in the pipes
- Check valves for wear at the valve disc and seat
- Replace gland thread if needed.
- Cleaning of pipe header from inside by opening end cover / flange

Repairs: The following items can be repaired and made functional. If they are found beyond repairable, then need to be replaced by **new one by the contractor**.

- All types of valves including gate, globe, ball, butterfly, non-return, balancing, float, purging, needle valves etc.
- Insulation breaks in piping, tank, etc.
- Leakages in pipes, flanges, joints and fittings, valve glands / seat and pinholes in piping & storage/expansion tanks have to be repaired. If replacement of pipes, flanges, gaskets, glands/ seat and fittings are required, it will be in contractor's scope.

7. A.H.U. / CENTRIFUGAL BLOWERS / AIR WASHAER/ KITCHEN EXHAUST/ ROOF EXTRACTORS/ EXHAUST FANS/ BLOWER UNIT OF PACKAGE AC UNITS

Monthly:

- Check condition of drive coupling, sleeves. Belts, pedestal bearings and alignment
- Check condition of vibration isolators.
- Check proper locking of inspection doors and their leakages.
- Clean Air filters, check for proper drainage of condensate.
- Clean and wash the cooling media of Air Washer (Cellulose Pads) with proper chemicals/ solutions.
- Clean and wash the kitchen hoods of kitchen exhaust with proper chemicals/ solutions.

Yearly:

- Inspect housing and wheel for rust and accumulation of dirt / suspended particles.
- Check fan wheel for damage and evidence of cracks of the blades
- Check bearings for wear and apply fresh lubricant
- Check and tighten mounting bolts
- Maintenance of pumps of air washer systems.

Repairs: Shaft, Canvass connection, belt guard, filter frame, blower can be repaired and made functional. If they are not repairable, then need to be replaced by new one **by the contractor**.

Replacements

The faulty Belt, bearing, shaft sleeves, runner / fan blade/ impeller of package unit, vibration isolator, air filters and drive packages etc. if found faulty, need to be replaced with new one **by the contractor**.

Note: Repairs or replacement of damaged housing of AHU / Centrifugal blowers / roof extractors/ exhaust fans/ blower unit of package AC will not be in the scope of the contractor.

8. DUCT/ DAMPERS (FIRE/VOLUME CONTROL) & GRILLS

- Check for any air leakage in the duct
- Check for any insulation damage for ducts.
- Check for disconnected and loose linkages
- Check for functional operation of dampers and grilles. Lubricate pins of dampers, grilles, wherever required.
- Check louvers for any damage and cleaning shall be followed
- Dismantling and Re-fixing of few duct pieces inside Helium Compressor Hall shall be carried out if required.

Repair:

- Repairing in the duct as per standard practice like riveting the joints, provided felt or gasket in the joints, patch work in the duct, insulation of the duct etc. If insulation of the duct gets damaged, the contractor shall rectify/ replace insulation for proper functioning.
- Canvass / damper / grills

Note: Repairs or replacement of damaged housing of dampers (fire/volume control) and grills will not be in the scope of the contractor.

9. COOLING TOWER:

Daily:

- Cleaning
- Check for operation of float valve, quick fill valve, equalizer connection

Monthly:

- Check cooling water being circulated for the suspended particles, algae formation, if. Find so; refill the circuit with fresh water.
- Check cooling water being circulated for the hardness as in PPM. If it is more than 30 ppm, blow down water partially and make up with fresh soft water.
- Drain the water and clean the sump of cooling tower
- Clean pot strainer/Y-strainer
- Check the condition of fills, if required, clean the fills with detergent/ suitable cleaning agents.
- Check for operation of shut off valves.
- Check for belt tension, oil level in the gearbox assembly.

Repairs:

The following items can be repaired and made functional. If they are found not repairable, then need to be replaced new one **by the contractor**.

- Water line leakage.
- All types of valves including float valve, quick fill valve, drain valve, etc.
- Gear box, strainer, eliminators
- Repairs of FRP panel / basin.

Replacement

The following item, if found faulty, need to be replaced with new one **by the contractor**.

- Bearings, Blades of fan, fills, eliminators, nozzle, distribution channels.

NOTE: Repairs or replacement of damaged housing of cooling tower will not be in the scope of contractor.

10. FAN COIL UNIT:

Quarterly:

- Cleaning air filter, strainer.
- Motor bushing oiling
- Cleaning drain pan & tray
- Check for the operation of fan speed regulator
- Check for the drainage of condensate.

Yearly:

- Cleaning of cooling coil by wire brush.

Repairs

The following items can be repaired and made functional. If they are found beyond repairable, then need to be replaced by new one by the contractor.

- Water line leakages
- Welding, brazing & flaring
- Fan motor rewinding
- Drain pan, motor mounting arrangement, insulation of chilled water line and drain line

Replacement: Strainer, runner bearings, bushings, connector strips, capacitors, selector switch, inlet / out let valves, if found faulty, need to be replaced with new one **by the contractor**.

Note: Repairs or replacement of damaged housing of unit will not be in the scope of contractor.

11. ELECTRICAL MAINTENANCE:

a. MOTOR (COMPRESSOR, PUMP, AHU, FCU, BLOWER, COOLING TOWER, DEGASSER ETC.)

Daily:

- Cleaning of motor

Quarterly:

- Lubricate bearings.
- Check for proper glanding & tightness of connections

Yearly:

- Dismantle the motor and apply grease on the bearings. Check for cleanliness of air passages, windings, remove dust dirt and grease, which may cause Flashing.
- Inspect visually the starter windings and measure insulation resistance.
- Inspect coil condition in the slots, condition of wedges and movement and evidence of coil looseness
- Inspect coil condition in the end winding, coil surface, distortion and insulation swelling
- Inspect rotor for cracked bars and rings for correction to bars
- Check air gap uniformity and record as indication of bearing wear

Repairs: The Rewinding of motor, Rotor & stator can be repaired and made functional. If they are found not repairable, then need to be replaced **by the contractor**.

Replacements: **Bearings, Shaft sleeves, Cooling fan, Gland, Terminal box, Glands, Studs & Lugging, if found faulty, need to be replaced with new one** by the contractor.

b. ELECTRICAL PANELS (POWER, ANNUNCIATION, FIRE, MICROPROCESSOR PANEL OF SCREW CHILLER) AND THEIR CABLING & WIRING:

Daily:

- Check for any tripping, chattering in the electrical parts, abnormal noise, overheating in the panels
- Check whether indication lamps are working
- All circuit boards for healthy contact minor repairs/services/cleaning etc.

Monthly:

- Check for the proper working of all ammeters, voltmeters, Hour meters, kWh meters, overload relays, contactors malfunction etc.
- Clean the panels from inside with the help of the blower/ vacuum cleaners (Quarterly)
- Check all the cables for overheating, tightness of the glands, lugs & crimping.
- Check the fuse-link & fuse holders.
- Check the control wiring of the panel along with the controls for the proper functioning and tripping at the preset parameters.
- Check and maintain the soft starter, Microprocessors panel of Screw chiller packages.
- Check and maintain variable speed drives for RF cooling pumps

Yearly:

- Check the operation of ACB, MCCB, MCB, Isolators, SFU and servicing of the same.

Repairs: ACB, MCCB, isolators, Contactors, Bus bar, Cable termination with glands, Various electronic cards like AO, AI, DO, DI, AM & motherboards can be repaired and made functional. If they are found not repairable, then need to be replaced by the contractor.

Replacements: **Fuse links, ACB, MCCB, MCB, overload relay, single phase preventer, push buttons, indicating lamps, voltmeter, ammeter, kWh meter, no volt coils, selector switches, solenoid valves, fuse holders, relays, timer, limit switches, cooling fans,**

capacitors, etc. items if found faulty, need to be replaced with new one by the contractor.

Note: Repairs or replacement of damaged body of the panel will not be in the scope of the contractor.

12. DX-TYPE AIRCONDITIONING UNITS/ AIR COOLED PACKAGE AC/ DUCTABLE AC:

Quarterly:

- Check proper locking of inspection doors/cover and their leakages.
- Clean Air filters, check for proper drainage of condensate.
- Cleaning of air filters.
- Cleaning of Cooling Coil and Condenser with nylon wire brush and air blower.
- Inspect blower fan motor drive, check tension of V-Belt, bearings, alignments, vibration isolator, electrical connections etc.
- Lubrication, wherever necessary
- Check Electrical wiring in all respect for smooth operation of the unit.
- Check the operation of all controls.
- Check the operation of heater (for RH control) with all its associated controllers.
- Check operating parameters like Room temperature, SA/RA temperature, current, voltage etc. and maintain the record.

Yearly:

- The drain tray of all DX-AHU/ packaged units should be painted once in a year with two coats of synthetic enamel paint or as and when required by IPR.
- Please refer earlier description covered for compressor, condenser, and blower, cooling coils, refrigerant piping and electrical maintenance.

Repairs and Replacements:

- Repairs or Replacements will be applicable whenever required, as mentioned under compressor, evaporator & condenser, instruments and controls, refrigerant pipes, drain piping, blowers, AHU, electrical maintenance etc. All such repair or replacement **in the contractor's scope.**

13. VRV/ VRF TYPE AIR CONDITIONING SYSTEM:

Fortnightly:

- Check operating parameters like Room temperature, SA/RA temperature, current etc. and maintain the record.

Monthly:

- Inspect fan motor drive, electrical connections etc.
- Check operating parameters and the operation of all controls.
- Lubrication, wherever necessary

Quarterly:

- Cleaning of air filters.
- Cleaning of Cooling Coil and Condenser with nylon wire brush and air blower.
- Cleaning of complete unit.
- Oiling / Greasing of fan motor.
- Check operating parameters and the operation of all controls.
- Lubrication, wherever necessary
- Check Electrical wiring in all respect for smooth operation of the unit.

Yearly:

- The drain tray of all ductable units should be cleaned properly and painted once in a year if required with two coats of synthetic enamel paint or as and when required by IPR.
- Please refer earlier description covered for compressor, condenser, and blower, cooling coils, refrigerant piping and electrical maintenance.
- Checking gas leakage in circuit, if any. If leakage found, need to rectify and do necessary service/replacement of parts and again charge the circuit for satisfactory performance of that circuit.

Repairs and Replacements:

- Repairs or Replacements will be applicable whenever required, as mentioned under compressor, evaporator & condenser, instruments and controls, blowers, electrical maintenance etc. All such repair or replacement **in the contractor's scope**.
- Rewinding of motor & gas charging.
- In case of any fault with electronic operating kit/ drive/EEV, complete kit/drive/EEV should be replaced.
- The mechanically / electrically failed sealed compressor should be replaced with factory repaired / new compressor. In the case of repaired compressor, the repair should be carried out at the supplier's / authorized dealer's factory.
- If electrical cable having any problem, it should be replaced by new one and after that electrical circuit shall be checked for smooth operation of the unit.

14. WATER TREATMENT PLANTS INCLUDING DM WATER PLANTS, MIXED BED UNITS, DEOXYGENATION UNIT, WATER SOFTENING PLANTS:

Daily:

- Check for operating parameters.
- Check the hardness (PPM as CaCO₃) of outlet soft water from Water softening plant. When the hardness of outlet water more than 5 ppm, the Water Softening Plant get exhausted. The arrangement of test kit for testing the hardness of soft water, commercial salt for regeneration and regeneration of both water softening plant shall be in the **contractor's scope**.
- Also regular check for the conditions of Mixed bed, DM Plants and De-oxygenation plant. Whenever any of these plants got exhausted, then contractor has to perform regeneration of the Mixed bed, DM Plants and De-oxygenation plant. Supply of Acid and Caustic for regeneration is in the scope of the contractor.
- Resin replacement will be in IPR scope as and when required.

Monthly:

- Check for cleanliness of stirrer, HCL regeneration container etc.
- Check the operation of all valves / controls like, gauges, sensors, conductivity meter, level indicator, oxygen content indicator etc.
- Check proper working of air blower and degasser unit

Yearly:

- Check the condition of resins.
- Check the condition of various valves, pumps & piping.

Repairs and Replacements:

- Repairs and Replacements will be applicable whenever required, as mentioned under pumps, blowers, instruments and controls, piping, valves, electrical maintenance etc. All such repair or replacement in the **contractor's scope**.

15. GENERAL TERMS & CONDITIONS, APPLICABLE TO ALL PLANTS:

1. It is to be noted that **any damage occurs due to faulty operation or maintenance of the contractor** in the plant, the contractor has to carry out necessary repair with the supply of parts, consumables within minimum possible downtime and made functional. If they are found not repairable, then the same needs to be replaced **with new one without any extra cost**. This will be applicable to all equipments, instruments and controls covered in the scope of contractor as well as those equipments, instruments and controls which are part of the plant but not covered **in the scope of contractor**.
2. Notwithstanding as to what is specifically stated under PLANT MAINTENACE SCHEDULE, it shall be responsibility of the successful tenderer to attend to all the preventive & routine maintenance and repairs and breakdown services including replacement of necessary parts and components.

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PLANTS MAINTENANCE SCHEDULE

(For equipments covered under item Sr. No. 1 to 42 as per Annexure-I.b)

- 1. Chiller, Pumps, motors, piping, Instruments and controls, MB unit, De-Oxygenation unit, Electrical Panel etc:**
Necessary repairs and replacement will be carried out **by the contractor** as per the details mentioned under Annexure-II.
- 2. For Plate Heat Exchanger:** if leakages found in the PHE, the necessary repairs will be carried out **by the contractor** with the help of manufacturer (if required) without any extra cost.
- 3. Replacement of damaged housing of pump, motor, PHE, electrical panel, MB and DO unit will not be in the scope of the contractor.**

GENERAL TERMS & CONDITION, APPLICABLE TO PLANT:

- a) It is to be noted that **any damage occurs due to faulty operation or maintenance of the contractor** in the plant, the contractor has to carry out necessary repair with the supply of parts, consumables within minimum possible downtime and made functional. If they are found not repairable, then the same needs to be replaced **with new one without any extra cost**. This will be applicable to all equipments, instruments and controls covered in the scope of contractor as well as those equipments, instruments and controls which are part of the plant but not covered in the scope of contractor.

Notwithstanding as to what is specifically stated under PLANT MAINTENANCE SCHEDULE, it shall be responsibility of the successful tenderer to attend to all the preventive & routine maintenance and repairs and breakdown services including replacement of necessary parts and components.