CONSTRUCTION & SERVICES DIVISION, RRCAT

RRCAT- INDORE

AIR CONDITIONING WORKS

TECHNICAL SPECIFICATIONS

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SPECIAL CONDITIONS

1. Tenderers shall furnish complete details including make, model, capacity, ratings, accuracy class, protection class (as applicable) etc. along with the technical literature and catalogues for items offered by them (More specifically for the items listed in our preferred makes).

2. Tenderers shall submit activity wise bar chart for execution of the work along with their offer.

3. Adequate man power required for timely completion of the work shall be deployed by the contractor. Tenderers shall clearly indicates his manpower planning dedicated to the subject work in the offer in the following format :

Sr.No.	Description	Qualification & Experience	Total Number of Persons to be Deployed.
I)	Engineer		
II)	Site Supervisor.		
III)	Technician / Electrician		
IV)	Skilled / Semiskilled Labourers.		
V)	Unskilled Labourers.		

4. Tenderers shall also furnish all the following information required for evaluation under qualification criteria.

   a. Name and address of the firm.
   b. Name and address of partners.
   c. Capital / financial standing with proof of solvency.
   d. Details about total manpower available with details of qualification and experience.
   e. Details of available Toolings, Plant, Machineries, and Testing equipments etc..
   f. List of work completed in last three years with copies of completion certificates.

5. In their own interest, tenderers are advised to see the site conditions before submission of offer with prior permission from office of the Head C&S division, RRCAT. If required, request may be sent on e-mail csdoff@rrcat.gov.in.

6. **Security checks:** Entry/exit permission to contractor personal shall be as per security procedures. After acceptance of the contract, the contractor shall submit the personal details of the individuals he is likely to employ for the execution of work at site. The particulars of the individuals along with their police verification etc. shall be required by RRCAT for issuing entry permission. The contractor's authorized representatives shall be available during entry/exit for identifying his carts, trucks etc. by the security person and they shall fully co-operate with RRCAT security during progress of work at site. Any damage caused by the contractor's personnel shall be made good by the contractor.

7. The site should be clean and tidy on regular work completion. Rectification/reinstallation/making good etc. shall conform to the standard materials originally used in the work and finished work shall match with existing work in all respects to the entire satisfaction of RRCAT.

8. The contractor will not allow or permit the employees to participate in any trade union, agitation and other unlawful activities in the premises of RRCAT. It is the responsibility of the contractor to bring to the notice of his employees that they have no right whatsoever to claim employment in RRCAT by virtue of their employment under this contract.

9. The bidder shall be totally responsible for manpower deployment. All statutory compliances and correspondence with RRCAT shall be done by the bidder only.

10. Applicable guarantee period shall be 12 months from the date of commissioning or 18 months from the date of work completion, whichever is earlier. During guarantee period, contractor shall carryout all required repairs, replacement of damaged parts, site visits etc. free of cost.

11. The Power Control Centre shall be fabricated at the works of a reputed panel builder, having type tested design for 50 KA short circuit rating and temperature rise as per the tender for a comparable size of switch board.

12. Pre dispatch inspection at the manufacturer's works shall be carried out for major items. However waiver of inspection shall be at the discretion of the RRCAT competent authority.

13. Appropriate material handling equipments like crane, forklift etc. shall be arranged by the contractor at his own cost for working inside as well as outside the building. Contractor shall have adequate tools and plant for ducting, drilling, welding, handling, and other erection activities etc. Appropriate testing equipments and instruments required during commissioning shall be arranged by contractor at his own cost.

14. Any damage to the civil and electrical works due to activities of A.C. contractor shall be repaired & made same by the A.C. contractor at his own cost.

15. Terms of Payments :

(i) 80 % of the supply rate against supply of item. The item shall be duly insured and proof of insurance shall be submitted to the department.
(ii) 90 % of the supply plus installation rate against supply and successful installation of the item complete in all respect.
(iii) 100 % of the total rate against completion of the item in all respects with documentation as per specifications.

16. Validity of the offer will be 180 days (minimum).

17. Dy. CA, CAT in the tender documents if any where, shall be read as " Pay & Accounts Officer", RRCAT.

18. Interpreting Specifications : In interpreting the specifications, the following order of decreasing importance shall be followed in case of any confusion/ambiguity or any contradiction :

a) Schedule of quantities.
b) Detailed description of items.
c) Single line diagrams/Drawings.
d) Technical Specifications.
e) Relevant BIS/ISO or any other relevant international code applicable.

GENERAL DESCRIPTION & BASIS OF DESIGN

1. SCOPE :

The work stated in these specifications together with drawings cover the design, manufacturing / fabrication, delivering goods at site, its handling, installation, carrying out performance test at site, commissioning of the sub systems, equipment's and final testing, commissioning & documentation of entire HVAC system including submission of as built drawings.

2. BASIS OF DESIGN :

2.1 Location : Indore

2.2 Latitude : 22.43˚ North

2.3 Outside Design Conditions :

	DBT (˚F)	WBT (˚F)	RH (%)	WATER CONT. Gr./ lb
SUMMER	106	77	28	92
MONSOON	90	82	70	153
WINTER	50	45	65	36
2.4 DESIGN CONDITION OF SPACES (LABS)	77	64	50	70

2.5 Windows glass with Sun film coating.
2.6 Roof under deck insulation.
2.7 Base temp and range for labs 25±2˚C.
2.8 Base RH and range for labs 50±5%

3. DESCRIPTION OF WORK :

The scope of the work include design, supply, execution, testing and commissioning of the HVAC system for assembly line of high bay with Air cooled DX condensing units & AHU through ducted supply & partially ducted return fed by AHU with temperature and humidity control. The design conditions shall be as per defined heat load sheet and system drawings being part of this tender**.**

3.1 Power Supply :

430/415 Volts, 1 phase / 3 phase and neutral 50 Hz AC electrical power supplies including earthing in Air Handling Unit (AHU) Room at single point shall be provided

by the department and its further distribution, load sharing, termination as per standard practices etc. shall be in the scope of this tender. However capacity of power required will have to be given by the contractor in advance.

3.2 HEAT LOAD :

Based on the above parameters, heat load worked out is 22 TR. The detail heat load summery sheet can be referred. However, the tenderer should work out heat load & air quantities independently and confirm the same in the tenderer's confirmation.

3.3 AIR CONDITIONING SCHEME IN BRIEF :

To meet the stated requirements of temperature, humidity & other parameters, it is proposed to have ducted air supply and partially ducted air return thru DX type condensing units connected with Air handling Units to be installed in AHU room. The HVAC Electrical power & control panel shall be installed at suitable location in AHU room.

SPECIFICATION OF EQUIPMENT / MATERIAL & INSTALATION STANDARD

1. DOUBLE SKIN AIR HANDLING UNIT :

AHU shall be sectionalized construction consisting of mixing chamber, filter section, coil section, humidifier section, heater section, blower section and sandwich type of S.S. drain pan and drain outlet as required. The Air Handling Unit (AHU) shall be constructed from outer skin with 22 G thick precoated G.I. sheet & plain 22 G thick inner G.I. sheet with 43 mm thick injected PUF insulation with Aluminium extruded frame work of 2.0 mm thick hollow profile. The AHU shall have suitable inspection doors for filter, coil & blower sections. The inspection doors should be made air tight with suitable neoprene rubber gasket.

1.1 Coil Section :

DX type 6 rows deep cooling coils shall be Aluminium finned and copper tube with fins firmly bonded to tubes. The coils shall be of 24 Gauge copper tubes. The capacity of the coils shall be as required under the schedule of quantities. Velocity of air across coil face shall not exceed 500 FPM for 6 Row coil.

1.2 Blower Section :

The blower shall be statically and dynamically balanced DIDW backward curved centrifugal blower preferably low rpm. Blower wheels and scrolls shall be fabricated from best quality sheet steel. The blower wheels shall be of the backward curved, multi-blade type enclosed in a housing and mounted on a common shaft. Blower scrolls shall be fitted with die formed side sheet streamlined inlet and guide vanes to ensure smooth air flow into the blower. The blower motor shall be mounted on a adjustable base frame fitted on a common extruded Aluminium channel using anti vibration mountings for silent and vibration free operation. Belt guards shall be provided to enclose the pulley sheaves and belts.

1.3 Drain Tray/Drain Pan :

The drain pan shall be of SS304 sandwiched type and insulated with 19 mm thick Nitrile rubber class ‘O’ insulation. Drain outlet should be provided on both sides of the tray.

1.4 Filter Sections :

The filter section shall be as per design requirements as specified in BOQ, meant for easy removal and maintenance. The pre filter section shall be with washable type of filters having 90% efficiency down to 10 micron filtration of preferred makes. The filter sections shall have sufficient space and inspection doors on both sides for loading and unloading of the filters.

1.5 Mixing Chamber :

The air handling unit shall comprise of mixing chamber of adequate size for fresh air and return with volume control dampers. Fresh air shall be inducted into the AHU thru a separate duct from the perimeter walls through inlet cowl, coarse filter, damper & bird Screen.

1.6 Access Doors :

The air handling unit shall be easy-lock type, double skin leak tight access doors of sufficient size.

1.7 Humidifier Section :

The air handling unit shall comprise of humidifier section with steam humidifier complete with required water heaters/transducers, float valve, low water level safety switch, overflow, piping and necessary fittings.

1.8 Heater Section :

The air handling unit shall comprise of heater section for mounting strip heaters with suitable capacity strip heaters (Pre heaters & Re heaters, the pre heaters will be installed in fresh air duct) complete with terminal connections, properly insulated with fire retardant materials with sensors and controllers, inspection doors etc.

1.9 Accessories :

The air handling units shall be complete with all mandatory sub systems, components or controls required for the defined functioning of the systems.

1.10 Details Pertaining to AHUs :

AHU No.	TR	CFM Range
1	22	11000 ±20%

2. Ball Valves :

The ball valves for condensate drain water piping shall be with forged carbon steel body & S.S. working parts. The end connection of the valve shall be screwed female type.

3. Refrigerant Piping :

The refrigerant piping shall be of hard / soft drawn 18 G copper pipes. All joints of hard copper piping shall be hard brazed. All the joints of soft copper tubing will be with flare fittings or soft soldered. All horizontal lines shall be pitched to 10 mm for every 3 meters in the direction of the refrigerant flow, for proper return of the oil to the compressor. All piping shall be adequately supported and isolated from the supports by means of suitable vibration isolators. The extended piping length shall be provided with expansion joints/ looped joints to accommodate differential expansions. Refrigerant lines shall be insulated with 19 mm thick pre formed, Aluminium foil pre clad Nitrile Rubber sleeve.

4. G.I. Ducting Works :

Ducts shall be prefab (factory fabricated, all joints made on automated lock forming machines & special toolings) and made of galvanized steel sheet as specified in the BOQ. The galvanized steel sheet shall be of class VIII with Zinc coating of 175 gm./mt² confirming to IS: 277 of approved / preferred makes . The fabrication/construction, erection, testing and performance of the ducting system shall confirm to the SMACNA – 1995 standards (HVAC Duct Construction Standards – Metal and Flexible – Second Edition – 1995 – SMACNA). All the transverse joints / connections shall be flange joint / connection and all the gaskets shall be of neoprene rubber. All duct hangers, supports and its mountings shall be as per above mentioned standards. All hardware shall be hot deep galvanized steel.

5. Dampers :

All dampers shall be of 18 S.W.G. G.I. sheets louver dampers of robust construction and tight fitting. The design, method of handling and control shall be suitable for the location and service required. Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation, control or setting in any desired position. Dampers and their operating devices shall be made robust, easily operatable and accessible through suitable access doors. Every damper shall have indication device clearly showing the damper position at all times. All the bushing will be of brass only.

Fire dampers shall be provided between each air handling unit room and the rest area. The fire dampers shall confirm to UL-655 and other applicable fire codes. The dampers shall be operated through solenoid valve & fusible link duly complete with required control wiring up to AHU panels.

6. Grilles and Diffusers :

All grilles (SA & RA), diffusers (SA & RA) will be made from heavy gauge extruded Aluminium sections as specified in BOQ, duly powder coated to match the interior requirements of Architect. All the supply air / return air grilles / diffusers will be provided with opposed blade dampers fabricated from heavy gauge Aluminium sheet duly powder coated. The damper should be suitable for operation from front face of grilles / diffusers. All the grilles & diffusers shall be fixed/installed by providing 40 mm x 40 mm thick good quality teak wood frame. Where ever required the grilles and diffusers shall be decorated by providing teak wood ribs.

7. Civil Works:

All the civil works including puncturing bricks / concrete masonry etc. made by contractor for A.C. works including fixing supports etc. and finally restoring it back to match original finish shall be in the scope of this tender.

8. **Flexible Connections:**

Air handling units and fans/blower shall be connected to duct network/ plenum by inserting at air inlet and air outlet a water proof fire retardant double canvass sleeve with zipped ports for TAB practices. Each sleeve shall be minimum 150 mm long, securely bolted to duct and units. Each sleeve shall be made smooth and the connecting duct work rigidly held in line with unit inlet or outlet.

9. Testing :

i. After completion all such system shall be tested for leakage.
ii. The entire air distribution system shall be first smoke tested for joint leakages, corrected/adjusted then whole supply and return circuits/grill dampers shall be balanced

to for air quantities as required in various zones and rooms to maintain the specified room conditions. The final TAB (testing, Adjusting and balancing) parameters of air quantity, velocities through each grille or diffuser shall be recorded and submitted to the department for approval before acceptance and taking over of the entire system.

10. Painting :

Angle iron flanges, hangers and supports shall be painted with 2 coats of anti rust primer and those remaining uncovered shall be further painted with 2 coats of synthetic enamel paints of required color.

11. Insulation :

11.1 For G.I. Ducting :

A) Thermal / Acoustic Insulation :

For thermal insulation : Supply / Return air duct shall be insulated with Aluminium foil pre clad Nitrile Rubber class 'O' insulation of 15 mm thick as specified in BOQ.

For acoustic insulation: Supply / Return air plenum and connecting ducts shall be insulated with Open cell elastomeric foam based synthetic rubber (NBR) class 1, density 140-180 Kg./m^3 of 15 mm thick in sheet form as specified in BOQ.

Method of applying the insulation :

a) Clean the duct surface to be insulated.
b) Apply a thin layer of tar paints of Shali coat / Ticky tar.
c) Apply a thin coat of good quality rubber based Adhesives like SR998 or better.
d) Fix the insulation of specified thickness over the surface of the duct tightly.
e) Secure with 16 Gauge G.I. wire. All the joints shall be sealed with IS quality BOPP tape.

ANNEXURE - I

1.0 TESTING OF AIRCONDITIONING SYSTEM :

1.0.1 Routine and type tests for various items of equipment shall be performed at the contractor's work in presence of department deputed engineer and the test certificates & compliance report shall be submitted. All functional test shall be conducted and recorded at site during final testing & commissioning.

1.0.2 Testing & commissioning of HVAC system shall be carried out as per standard ASHRAE practices.

1.0.3 The performance test to determine whether or not the full indent of the specification is met shall be conducted by the contractor. After notification to the employer that the installation has been completed and the system has run continuously for a period of at least two weeks, the contractor shall conduct the tests in the presence of employer / employer's representatives, such test as specified to establish the capacity of various equipments supplied and installed by the contractor.

1.0.4 The contractor shall operate test and adjust the air conditioning system units, fans/blowers, motors, all air conditioning appliances including adjustment of regulators, dampers etc.

1.0.5 All test equipment, labour, operating personnel required for this test shall be furnished by the contractor to enable the system to put in continuous running test for a period of 3 days after all other tests and adjustments have been made.

1.0.6 The contractor will be provided with electrical power for testing by the department. The performance test shall be conducted during peak summer, peak monsoon and peak winter.

2.0 PROCEDURE :

2.1 Design Conditions :

The inside and outside conditions will be recorded for 48 hrs. (2 days) duration on hourly basis. The outside and inside Dry Bulb and Wet Bulb temperature shall be recorded by the means of a sling psychrometer. The relative humidity shall be computed from the psychrometric chart. The inside Dry Bulb temp. and relative humidity shall fall with in the specified limit.

2.2 Cooling Coil of AHUs :

The flow of air over the cooling coil will be measured by recording the velocity of air across each filter placed before the cooling coil. The velocity shall be measured with digital anemometers.

Air quantity across the filters = velocity of air across the filters in FPM x net filter area (in sq. feet).

The wet bulb temperature of air entering the coil and that leaving the coil shall be measured. The enthalpy of entering and leaving air shall be noted from the psychrometric chart corresponding to the wet bulb temp. recorded.

Say,
He - Enthalpy of entering air in Btu / lb.
Hl - Enthalpy of leaving air in Btu / lb.
Ve - Specific volume of entering air [CFT. / lb. of air]
Vl - Specific volume of leaving air [CFT. / lb. of air]
Average specific volume = (Ve + Vl) / 2 = V (CFT. / lb. of air)
Cap. of cooling coil = (CFM x 60) / V x (He - Hl) / 12000
(CFM x { He - Hl } x 4.5 / 12000)

2.3 Air Balancing :

After the desired inside conditions are achieved, the quantity of air thru every outlet shall be measured.
Air quantity in CFM = Air velocity at the outlet in FPM x Effective area of the outlet in Sq. Ft.

3.0 Functional Tests :

3.1 Electrical equipment :

i) All the cables shall be tested for continuity and absence of cross phasing. Insulation resistance between the phase conductors and the earth shall be measured with the help of a 1000 V Megger.

ii) Motors :

a) Insulation resistance of all motors shall be tested with a megger and the value shall not be less than 1 Meg – Ohms, The motor winding shall be dried out and winding shall be given a coat of approved insulating varnish.
b) Starting current shall be recorded every time the motor is started.
c) Starter operation shall be checked for single phasing by moving one of the phase.
d) Over load protection shall be checked by altering the starter thermal overload setting.

For all other electrical equipments the testing procedure are specified in the electrical part of section – 12 (SPECIFICATION OF EQUIPMENTS / MATERIALS & INSTALLATION STANDARDS) of this tender document.

4.0 Apart from the above, all other tests viz: Design qualification test, Installation qualification test, Performance qualification test, Operation qualification test, Site acceptance test, Safety acceptance test etc. of entire HVAC system shall be carried out by the contractor as per standard ASHRAE practices.

5.0 Documentation - Complete Documentation of entire HVAC system complete with design qualification, installation qualification, performance qualification, operation qualification, site acceptance test, safety qualification test and as-built drawings along with Dos and Dont's lists etc. shall be prepared by the contractor and to be submitted to the department for approval.

MODES OF MEASUREMENT

The following measurement code shall apply to this contract :

For AHU :

AHU with filter sections along with filters as specified in BOQ, Fan/blower and coil section with coil & drain pan, humidifier section with humidifier, heater section with heater, motor with base frame of motor, drive and guard suitable for motor, mounting frame, anti-vibration mountings, fire retardant flexible connections, mixing chamber for fresh air & return air with volume control dampers and all the sections with required components/equipments and accessories as specified in BOQ shall form one unit of measurement.

Installation, testing and commissioning is a part of above points.

SHEET METAL WORK :

a) Ducting

- **i)** All sheet metal ducting work will be measured in terms of final sheet area installed in Sq. meters.
- **ii)** No measurement of vanes, splitters, deflectors, access doors etc. which are required to be installed in the duct work will be made as the same shall be deemed to be part of ducting work.
- **iii)** Duct fittings such as bends, elbows, tap offs, collars, transformation pieces etc. shall be treated as ordinary duct pieces with their length measured along centre line.
- **iv)** No duct support, stiffening member etc. shall be measured separately. All such supports / hangers shall form part of duct work.
- **v)** Equipment connections such as canvas / reinforcement shall be deemed to be part of the duct work and no separate measurement will be allowed.

b) Grills :

All grills will be measured in terms of effective area. No separate measurement will be given for teak wood frames.
Example : 600 mm x 150 mm grilles will be measured as 0.09 Sq. meter.

c) Diffusers :

Diffusers will be measured in terms of effective area of diffusers. No separate measurement will be given for teak wood frame.

d) Dampers :

i) All duct dampers shall be measured separately in terms of effective area in Sq. meters.
ii) Fire dampers will be measured in terms of effective area in Sq. meters.
iii) No separate measurements will be made for fresh air / exhaust air inlet / outlet louvers, pre filter, bird screen etc.

INSULATION :

A) Ducting Insulation :

i) Duct insulation will be measured on the basis of centre line of insulation and not the outer line of insulation.

Example : Perimeter x Length = Area Sq. meter.

ii) No special measurement shall be made for insulation of bends, transformation pieces, tap offs, elbows etc. All such insulation shall be treated as standard duct insulation.
iii) Insulation items shall include all accessories and finishes as specified. No separate measurement will be made for such items.

INFORMATION TO BE FURNISHED BY THE TENDERER ALONG WITH THE TENDER :

1. i. Air Handling Unit :

1. Manufacturer
2. Model No.
3. Type of Unit
4. Overall dimension mm.
5. Weight Kg.
6. Noise level
7. Type of construction material.

ii. Fan / Blower Section :

1. Type of fan / blower
2. Fan Selection Chart
3. Air quantity Ft^3 / min.
4. Total static pressure of water column.
5. Fan / blower speed RPM
4.A. Maximum permissible Fan / Blower RPM
5. Fan / blower motor HP
5.A. Fan / blower motor PF
5.B. Fan / blower motor efficiency
6. Outlet velocity ft / min.
7. Fan / blower dia. mm
8. Balancing (Static and dynamic)
9. Material
10. No. of Vanes.
11. Fundamental frequency
12. Actual power consumption
13. Type test certificate from OEM

iii. Cooling Coil :

1. Coil Selection Chart
2. Coil fin and tube material and FPI.
3. Grand total heat cap. Kcal / hr.
4. Air quantity through coil Ft^3/ min.
5. Entering air temperature. DB
6. Entering air temperature. WB
7. Leaving air temperature. DB
8. Leaving air temperature. WB
9. S. H. F.
10. A. D. P.
11. Bypass factor.

12. Face area M².
13. Row deep.
14. Type of control.

iv. Filter Section :

1. Gross filter area M²
2. Velocity through filter mtr. / min.
3. Efficiency %
4. Type of filter media
5. Filteration level
6. Number of filters
7. Make of filter
8. Overall dimension

LIST OF APPROVED / PREFERED MAKES

Sr. No.	COMPONENT	APPROVED / PREFERED MAKE
1.	COIL	VOLTAS / BLUE STAR / LG / SAMSUNG / EDGETECH / ZECO / ETHOS / DIAKIN
2.	MOTORS	BHARAT BIJLEE / NGEF / ABB / JYOTI / KIRLOSKAR
3.	PUMPS	KIRLOSKAR / BEACON
4.	AIR HANDLING UNIT	ETHOS / BLUE STAR / CITIZEN / CARRIER / EDGETECH / ZECO
5.	BLOWERS	KRUGER / NICOTRA / Ebm- NADI
6.	AIR SHOWER/FILTERS: PRE / MICROVEE / HEPA	DYNA / KLENZAIDS / PYRAMID/AAF
7.	PIPES	BST / TATA / JINDAL
8.	COPPER PIPES / TUBES	JINDAL /CARRIER (TOTALINE)/ JAIPURIA / MANDEV
9.	RIGID PVC PIPE	FINOLEX / RELIANCE / TATA
10.	VALVES	
A.	GV / GLV / NRV BALL VALVE	LEADER / TRISHUL / KIRLOSKAR / L & T/EMERSON/DANFOSS
	A. BUTTERFLY	KEYSTONE / AUDCO / ADVANCE
	B. BALANCING	ADVANCE
11.	INSULATION	
	A. NITRILE RUBBER	ARMAFLEX /SUPERLONE/SUPREME
	B. FIBRE GLASS	FGP / UP TWIGA / KHIMCO
	C. EXPANDED POLYSTYRENE	BEARDSELL / COOLINE

D.	EXPANDED POLYURETHENE	NIKIFOAM
E.	PHENOTHERM	BAKELYTE HYLAM
12.	CONTROLS / MEASUREMENT INSTRUMENTS	
A.	HUMIDISTATES	JOHNSON / HONEYWELL / PEEN
B.	THERMOSTATS	JOHNSON / HONEYWELL / WHITE RODGER
C.	THERMOMETERS	H. GURU / TEDDINGTON
D.	PRESSURE GAUGES	H. GURU / FIEBIG
E.	FLOW SWITCHES	INDFOSS / DANFOSS
F.	FLARE NUTS / CU. FITTINGS	CASTEL / DANFOSS / INDFOSS
G.	MIXING / 3-WAY VALVES	JOHNSON / HONEYWELL / STAEFA / SAUTER
H.	MODULATING MOTORS	BELIMO / HONEYWELL / STAEFA / SAUTER
13.	CONDENSING UNIT FOR DX TYPE AHU's	VOLTAS / CARRIER / YORK/ TOSHIBA / HITACHI / BLUE STAR / LG
14.	SPLIT TYPE AIRCONDITIONERS	CARRIER / VOLTAS / BLUE STAR / HITACHI / TOSHIBA / LG
15.	CLEAN ROOM DOORS	METAFLEX / SAKTHIMET / MPP
16.	GRILLES / DIFFUSERS	AIR MASTER / COSMOS / DYNACRAFT AIRFLOW /CARRYAIR
17.	DUCTING SHEETS	SAIL / NIPPON /JINDAL/ TATA
18.	DAMPERS	AIR MASTER / COSMOS / DYNACRAFT / AIRFLOW / GEORGE RAO & CO.
19.	ENERGY METER	G. E. C. / TAYLER
20.	WATER SOFTENING PLANT	ION EXCHANGE / THERMAX
21.	ELECTRONIC SCALE CONTROLLER	SCALE MASTER / AKAR IMPEX

22. AUTOMATION SYSTEM	STAEFA / TATA HONEYWELL / JOHNSON
23. FIRE DAMPERS	T. S. C. / CARRYAIR / GEORGE RAO & CO.
24. LECTRICAL PANELS	RITTAL / HAVELLS / SIEMENS / ELECTRONIC APPLYANCES
25. POWER CABLES	CCI / GLOSTER / FINOLEX / HAVELS
26. CONTROL CABLE	NICCO / FORT GLOSTER / POLYCAB FINOLEX
27. ELECTRICAL COMPONENTS (SWITCHES , HRC FUSES ETC.)	SIEMENS / L & T / ENGLISH ELECTRIC
28. CIRCUIT BREAKERS	SIEMENS / L & T / ENGLISH ELECTRIC
29. METERING	MECO / AE / IMP / RUSHIBH
30. ELCB / ELMCB	DATAR / E. E.
31. CAPACITOR (APP)	SUBODHAN / KHATAU JUNKER
32. C. T. / P. T.	A. E. / KAPPA
33. L. T. BREAKER	SIEMENS / L & T
34. SWITCH FUSE UNIT	SIEMENS / L & T
35. M C C B	L & T / A B B
36. M C B	SIEMENS / MDS
37. PUSH BUTTONS	L & T / SIEMENS
38. INDICATION LAMP	L & T / RAAS CONTROL
39. AMMETER / VOLTMETER	ENERCON / AE
40. P. F. METWR	ENERCON / AE
41. FREQUENCY METER	ENERCON / AE

42. I D M T RELAY	E E / AVK SEC
43. CONTACTOR	SIEMENS / BCH
44. CONNECTOR	ELMEX / CONNECT WELL
45. SELECTOR SWITCH	SULZER / THAKOOR
46. ELECTRIC WIRE	FINOLEX / WIREFLEX / POLYCAB
47. CABLE GLAND	COMET / ELECTROMECH
48. LUGS & SOCKETS	DOWELLS / JAISON
49. ELECTRIC TIMER	SIEMENS / L & T
50. APFC RELAY	SYNTRON / CROMPTON
51. PVC TAPE	STEEL GRIP / BHORE
52. SCREW	NETTELFOLD / GKW
53. BIMETALIC CLAMPS & CONNECTION	SMOUTAN / PEC / MILIND
54. BUSBAR	COPPER
55. IONISATION SMOKE DETECTOR	APOLLO / SYSTEM SENSOR
56. OPTICAL SMOKE DETECTOR	APOLLO / SYSTEM SENSOR
57. CONTROLLER UNIT WITH POWER SUPPLY & BATTERY	DATS / HONEYWELL / VIJAY / MINIMAX