

**SECTION – 8810
HVAC WORKS**

SPECIAL PROVISIONS

1.0 HVAC System Concept

The air-conditioning system for Jinnah Sindh Medical University, Lecture Hall has been designed for cooling in summer only with Split type air-conditioning units.

1.01 Service Conditions for Auxiliaries

a) Power Supply

Electrical Circuit Voltages:

Nominal,	3-phase:	415 volts.
	1-phase:	240 volts.

For equipment ratings,	3-phase:	400 volts.
	1-phase:	230 volts.

Fluctuation in voltage applied to equipment:	(+/-)10% of equipment rated voltage.
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Frequency:	50 Hz \pm 2%
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1.02 Units

The units used in these specifications are as under:

Unit System : FPS (S.I)

2.0 WORK BY CONTRACTOR

2.01 Scope of Work

The Contractor shall furnish all labour, materials, equipment tools, appurtenances, services, temporary work and storage necessary to completely supply, install, test, commission, and maintain the HVAC system in accordance with these Specifications and Drawings. The Contractor shall maintain all the systems for a period specified under General Conditions of Contract.

Specifications are only general guidelines and by no means cover details of each equipment. These only spell out the intent of the requirement. The details have to be provided by the Bidders along with details of performance,

construction and technical literature with the Tender. The specifications are to be read in conjunction with Drawings.

All equipment and materials shall be brand-new bearing stamped ratings as required and must be approved by the Engineer prior to their use. Date of manufacturing of equipment shall not be earlier than the year in which the Tender is awarded. Any doubts about the practicability and implementation of Specifications and details shown on Drawings must be expressed and clarification sought before submission of Tender. Inability of the Contractor to implement these specifications after the acceptance of the contract shall be considered breach of contract.

2.02 **Services by the Contractor**

a) Maintenance During Maintenance Period:

The Contractor shall service and maintain complete HVAC system for specified period. The Contractor shall provide all personnel for maintenance. Qualifications, experience and number of all these personnel shall be subject to Engineer's approval.

2.03 **Related Works**

The Contractor shall perform all works related to HVAC system, whether specifically mentioned or not. These related works shall include, but not limited to:

- a) Electrical Works
as specified in technical provisions.
- b) All works related to cooling coil condensate disposal from HVAC equipment upto points shown on the drawings shall be the responsibility of the Contractor.
- c) Cutting, patching and repairing of civil works in accordance with Clause 1-06 of Section 1 of Technical specifications.
- d) Co-ordinating HVAC installation with other trades' work, by way of study of other trades' drawings and pointing out the areas of conflict to the Engineer before installing items of HVAC system.
- e) Door Louvers
- f) Protective fencing around HVAC equipment, if required.
- g) All concrete foundations and house keeping pads.

2.04 **Completion Time**

Time for completion shall be as specified under General Conditions of the contract.

3.0 **DESIGN CONDITIONS**

HVAC System has been designed for the conditions listed hereunder. These conditions are being given for the information of the Contractor to enable him to perform specified tests under these conditions.

3.01 **Outside Design Conditions**

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|----|-----------------------|----------------|
| a) | Summer Dry Bulb Temp: | 104° F (40° C) |
| | Wet Bulb Temp: | 86° F (30° C) |
| | Daily range: | 14° F (7.8° C) |
| b) | Winter Dry Bulb Temp: | 49° F (9.4° C) |
| c) | Latitude : | 24.8° North. |

3.02 **Inside Design Conditions (all airconditioned areas)**

- a) Dry Bulb Temp 75°F ± 2°F (24°C ± 2°C)
- b) Relative humidity 50% ± 10%

3.03 **Noise Criteria:**

All HVAC equipment shall be selected by the Contractor to obtain the following noise criteria:

- All air-conditioned areas NC 35-40

4.0 **DRAWINGS, EQUIPMENT SUBMITTALS, INFORMATION MANUALS, SAMPLES AND CONTRACTOR'S OTHER SUBMISSIONS**

4.01 **General**

All drawings, other information and samples must be supplied to the Engineer as laid down in these Specifications and as and when agreed during site meetings, in the Progress Chart or as instructed by the Engineer.

The Contractor shall submit, for approval, detailed submittals as specified and no material or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved Data Sheet, Catalogue cuts or samples of particular material. All submittals shall be in English Language and shall be supplied free of cost.

All submittals shall be made in triplicate with at least one in Original.

Approval rendered on submittals shall not be considered as a guarantee of measurements or building conditions. Where submittals are approved, said approval does not in any way relieve the Contractor from his responsibility for necessity of furnishing material or performing work as required by the Drawings and Specifications.

Failure of the Contractor in providing submittals in ample time for checking shall not entitle him to an extension of Contract time and no claim for extension by reason of such default will be allowed.

4.02 Drawings

The drawings issued with tender documents show the Scope of Work to be performed by the Contractor. These Drawings shall not be used as a basis for fabrication, construction or installation but shall be used for estimation for bidding purpose only. These drawings are not to be considered for defining the design of HVAC equipment to be furnished or defining the exact details of the installation under this Contract, but are only illustrative of the Specifications and HVAC System and show the general layout of the equipment forming part of HVAC System. These drawings are not to be scaled.

These drawings do not show every offset, bend or elbow which may be required in piping for the installation in the space provided. The routes and sizes of the piping, shown on these drawings are subject to change depending on the make of HVAC equipment to be provided by the Contractor. These sizes and routes of piping shall be adjusted at the shop drawing stage.

Work shown on the HVAC Drawings and not mentioned in the Specifications, or described in the Specifications without being shown on HVAC Drawings, shall nevertheless be held to be included in the Contract in the same manner as if they had been specifically shown upon the Drawings and described in the Specifications.

4.03 Shop Drawings

The Contractor shall make a detailed analysis of the requirements of work. Based upon such analysis he shall revise and amplify the Drawings and shall prepare detailed Shop Drawings at his own cost for complete HVAC System and Equipment. Initially he shall submit 2 preliminary copies each of all such Shop Drawings to the Engineer for obtaining approval. Once basic agreement is reached with the Engineer regarding the details then the Contractor shall submit 4 (four) copies each of all such Shop Drawings to the Engineer for obtaining his approval. After obtaining approval and after having in possession these approved Shop Drawings, the Contractor shall use these Shop Drawings for fabrication, construction and installation.

The work described on any shop drawing submitted shall carefully be checked by the Contractor for all clearances, field conditions, maintenance of

architectural conditions and proper co-ordination with all trades on the job. To this end, the Contractor during the shop drawing stage, shall ensure that he receives drawings of all other trades that might interfere with the proper installation of his work. No payment shall be made for any variations or alterations on site due to lack of knowledge of other trades. Any unresolved conflict between trades shall be referred to the Engineer for decision.

Equipment layout is to be detailed on shop drawings, showing the exact method of installing and clearly illustrating components to be used in making all connections.

Refrigerant and condensate drain piping drawings must be fully detailed, showing all piping in double line and indicating the precise sizes of all fittings used. Positions of hangers and supports with reference number must be given showing the type and method of installation of each hanger and detailing the type of hanger fixings with a reference number for each type.

All general layout drawings shall be drawn to $\frac{1}{4}$ inch = 1 ft. (1:50) scale. Details of hangers, methods of fixing of pipes, detailed cross section of pipes, risers, details of controls and piping hook-ups to equipment shall be drawn to 1 inch = 1 ft. (1:10) scale.

The Contractor shall prepare Drawings and Schedules showing precise details of holes in concrete, masonry, etc. and necessary sleeves required for passage of pipes, etc. Drawings and Schedules, approved by the Engineer must be available before any structural work requiring holes or other modifications, is constructed.

Signed and approved drawings shall not be deviated from unless a signed variation order or site instruction is issued in writing by the Engineer.

The Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him whether such drawings and particulars have been approved by the Engineer or not, provided that such discrepancies, errors, or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer.

4.04 **As-Built Drawings**

The Contractor shall supply to the Engineer a set of "As-Built" drawings showing the Contract works as installed, together with any other information necessary for operation and maintenance. 4 (four) copies of each drawing and other information shall be supplied, along with a reproduceable copy. As built drawings shall be supplied free of cost.

4.05 **Manufacturer's Data**

Manufacturer's performance data, certified factory drawings and/or curves of apparatus giving full information as to capacity, performance at different

operating and ambient conditions, dimensions, materials, electrical data and all information pertinent to the adequacy of the equipment shall be submitted for approval. Initially the Contractor shall submit one original published catalogue with other papers and one copy thereof. Once basic agreement is reached with the Engineer regarding the details then the Contractor shall submit three original published catalogues and other papers each of all approved material.

Manufacturers names, sizes, catalogue numbers and/or samples of all materials shall also be submitted for approval. Samples of imported materials and devices, literature of which has been approved, will not be required. All submittals shall be made in English language.

Submittals and shop drawings should, as far as possible, be complementary so that drawings and submittals can be crosschecked.

4.06 Samples

Contractor shall provide at his cost, samples of materials, instruments, gauges and electrical items, for approval by the Engineer before order is placed for the same. These samples shall include, but not limited to:

- i) Pipes and Fittings, each size to be used.
- ii) Pipe insulation.
- iii) Insulation adhesive and tapes.
- iv) Power and Control Cables.
- v) Electrical accessories.
- vi) Electrical conduits and fittings.
- vii) Anchor bolts, studs, etc. for hanging arrangements.
- viii) Any other item required by the Engineer.

Samples of imported items, literature of which has been approved will not be required.

5.0 TIME FOR DELIVERY

All imported and local equipment, plant and machinery shall be delivered at Site on such dates so as to ensure adherence to the work programme agreed with the Engineer later after award of the Contract. The Contractor shall keep the Engineer informed of the progress of the shipment and notify approximately 3 weeks in advance in writing, as to when the equipment will be ready for inspection by the Engineer and shall supply lists covering each consignment in sufficient detail to enable Engineer to check the contents of the packages, if he so desires.

6.0 STANDARDS AND CODE REQUIREMENTS

All equipment and materials under HVAC Scope of Works shall be furnished in conformity with latest edition of Applicable Standards of ASME, ASHRAE, ARI, SMACNA, TIMA, AMCA and applicable Government and Local Codes

governing the same in case of conflict, the stricter requirements shown/specified shall govern.

6.01 **Abbreviations**

Abbreviations for Codes and Standards referred in the Contract are as under:

1. ASME - American Society of Mechanical Engineers
2. ASTM - American Society for Testing & Materials.
3. ASHRAE - American Society of Heating Refrigerating and Air-conditioning Engineers, USA.
4. NFPA - National Fire Protection Association, USA.
5. ARI - Air-conditioning and Refrigeration Institute, USA.
6. GOVERN-
MENT - Government of Pakistan.
7. LOCAL - Local authorities of the city where project is located.
8. I.E.E. - Institute of Electrical Engineers, London.
9. NEMA - National electrical Manufacturers Association, USA.
10. AMCA - Air Moving and Control Association Inc. USA.
11. P.S. - Pakistan Standards.
12. B.S. - British Standards.
13. JIS - Japan International Standards, Japan

7.0 **INSPECTION, DAMAGES AND MATERIAL ORDERS**

7.01 **Inspection at Manufacturer's Shop**

All major equipment to be supplied under this Contract which has been manufactured or shop-assembled in or outside Pakistan shall be inspected and tested by the manufacturer and certificate of compliance to specified ratings, capacities, etc. be issued by the manufacturer.

7.02 Inspection at Site of Works

All equipment/materials supplied by the Contractor, shall be inspected by the Engineer after delivery of the same at site to assess any damage or short of quantities and any other requirements of the specifications. The Engineer will issue an inspection certificate if the supplied items of equipment and material are found to be satisfactory.

7.03 Damages, During Transportation, Storage & Installation

The Contractor shall be responsible for any damage of the equipment/material during transportation to site, storage and installation until satisfactory handling over the works to the employer. The Contractor shall replace any damaged equipment/materials at his own cost.

7.04 Material Orders

Duplicate copies of material or equipment orders and lists of stock required in this Contract shall be furnished to the Engineer. All orders and stock lists shall state the specification designation under which the material is to be furnished and shall bear reference to the drawing and part number, if any, pertinent thereto. Orders shall also state that material is subjected to testing and shall show the required date of delivery of the material to destination.

7.05 Acceptance of Materials

The acceptance of any material or equipment prior to installation shall in no way relieve the Contractor of any of his responsibilities for meeting all of the requirements of the specifications and shall not prevent subsequent rejection if such material or equipment is later found to be defective.

8.0 NAMEPLATES

The Contractor shall provide and attach to each major piece of equipment, a metal name and rating plate to be approved by the Engineer, giving the name and address of the manufacturer, the date and rating data. All ratings shall be in the unit system adopted for the Project, unless otherwise authorized by the Engineer.

9.0 MATERIALS AND EQUIPMENT TO BE IMPORTED

Imported materials whether procured from local market or imported specially for this project by the Contractor shall include, but not limited to the items listed hereunder :

- a) DX Split AC units
- b) Refrigerant Piping.
- c) Piping insulation.
- d) Rawl bolts, Foundation bolts, etc.

- e) Electrical Circuit breakers, contactors, relays, indication and measuring instruments, etc.
- f) Flexible connections

All rates and amounts filled in the BOQ and Appendices by the Contractor for equipment/material whether locally procured or imported under his own import licence shall be deemed to include but not limited to, the cost of items, custom duties, sales tax and surcharges, freight, marine insurance, local duties, sales tax and surcharges, clearance charges, inland transport and insurance, octroi, bank charges etc. All payments to the Contractor shall be made in Pakistani Rupees. Any variation in foreign exchange rate, custom duties and taxes etc. will not be payable.

10.0 RIGHT TO OPERATE PLANT

The Employer reserves the right to operate any and all Equipment after it has passed the Commissioning Tests and prior to Final Acceptance. All repairs or alterations found to be necessary during such operations, required of the Contractor, shall be made by the Contractor at such time as directed by the Engineer. The repairs or alterations shall be made in such a manner and at such a time as will cause the minimum interruption in the use of the Equipment by the Employer.

11.0 ERECTION INSTRUCTIONS, OPERATION & MAINTENANCE MANUAL

Erection Instructions in form of published installation manual, as furnished by the manufacturer of each HVAC equipment shall be provided by the Contractor.

All Erection manuals, operation and Maintenance manuals, drawings, etc., shall be supplied free of cost.

12.0 POWER SUPPLY

12.01 For Erection and Preliminary Testing

Power supply for erection and preliminary testing shall be the responsibility of the Contractor to be provided at his own cost.

12.02 For Commissioning and Final Testing

Power Supply for commissioning and final testing will be provided by the Employer.

13.0 MAINTENANCE PERIOD

The Contractor shall service and maintain complete HVAC System for a period specified in General Conditions of Contract. This service shall include all necessary adjustments, greasing, oiling and cleaning and the furnishing of necessary tools, instruments supplies and parts to keep the system in

perfect operating condition. All costs incidental to the above specified Servicing and Maintenance shall be deemed to be included in item "Maintenance Period" of the Bill of quantities. The Contractor may withdraw maintenance tools and instruments at the completion of Maintenance Period.

14.0 PERFORMANCE GUARANTEE

The Contractor shall guarantee performance as specified of HVAC equipment in conformity with the Provisions of the Contract.

15.0 SUFFICIENCY OF RATES AND CURRENCY OF PAYMENT

All rates and amounts filled in the BOQ and Appendices by the Contractor for equipment/material whether locally procured or imported shall be deemed to include, but not limited to, the cost of items, custom duties, sales tax and surcharges, freight, marine insurance, local duties, sales tax and surcharges, clearance charges, inland transport and insurance, octroi, L/C opening charges, bank charges, etc. Payments to the Contractor shall be made in local currency.

16.0 PACKING OF EQUIPMENT AND MATERIALS

All equipment and material shall be adequately packed at the manufacturer's works to protect them against damage, scratching, corrosion, dust, rain and moisture during handling, transportation and storage. The packaging shall be rigid enough to withstand normal service incidental to shipping and handling. Wherever necessary, crates/boxes shall be provided with lifting hooks attached by means of vertical rods or plates to strong bottom supports to enable rigging.

The following information shall appear inside all packages :

- a) Stock or identification number
- b) Description of contents/packing list
- c) Quantity of each item
- d) Invoice number
- e) Year of manufacture

17.0 INSPECTIONS AND TESTS

17.01 Inspection by Engineer

The Engineer shall inspect the works in progress as and when considered necessary by the Engineer and the Contractor shall provide full access and assistance to the Engineer for carrying out inspection to verify the conformity of works to general lay-out of HVAC System as designed and as shown on Drawings and as specified. Such inspection if made shall not relieve the Contractor from any obligations under the Contract.

17.02 Tests

a) General

- i) All Tests as specified shall be carried out by the Contractor's workmen. The Engineer shall witness the tests. The results shall be filled out by the Contractor in the forms prescribed by the Engineer. Three copies of filled out forms shall be submitted to the Engineer for review and approval.
- ii) The Contractor shall give the Engineer at least seven days notice in writing of the date on which any equipment will be ready for testing as provided in the Specifications and unless the Engineer shall attend within seven days of the date which the Contractor has stated in his notice, the Contractor may proceed with the tests in the Engineer's absence and shall forthwith forward to the Engineer three duly certified copies of test readings, on the forms prescribed by the Engineer. The Engineer shall give twenty-four hours notice in writing of his intention to attend any test.
- iii) The Contractor shall provide all labour, materials, apparatus, machines and instruments as may be necessary to carry out tests.
- iv) The cost of all Tests under this Clause shall be borne by the Contractor if such tests are clearly intended by or provided for in the Specifications of Bill of Quantities.
- v) As and when any equipment or HVAC System or part thereof shall have passed any test the Engineer shall furnish to the Contractor a certificate in writing to that effect.
- vi) The Engineer may reject any part or parts of Equipment which he shall after testing decide is not performing in accordance with the Specifications and Drawings and he shall give to the Contractor within fourteen days of such testing notice in writing of such rejection stating therein the grounds upon which his decision is based.

b) Preliminary Tests

Preliminary Tests as specified in Technical Specifications, shall be carried out on completion of installation of that equipment or at such time, which the Engineer may require.

d) Performance Tests

These tests as specified in Technical Provisions shall be carried out after successful completion of Commissioning Tests, during appropriate season. Performance Tests may be carried out during Maintenance Period.

e) Reliability Trial Tests

- i) On successful completion of Performance Tests on all equipment, and after having obtained certificate to that effect, in pursuant of sub-clause a(v) hereof, the Contractor shall inform the Engineer in writing of his readiness to commence the Reliability Trial Test of HVAC System. Cooling and Heating Tests shall be carried in appropriate seasons and the Engineer shall, within fourteen days of receipt of such information shall forward his consent for commencement of Reliability Trial Test as specified in Technical Specifications, after having satisfied that all the requirements for such Tests have been completed.
- ii) If any Reliability Trial Test is not to the satisfaction of the Engineer, such test shall be repeated at such time as the Engineer may direct.