



## National Centre for Radio Astrophysics

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

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Website : [www.ncra.tifr.res.in](http://www.ncra.tifr.res.in)

### TENDER NOTICE NO. 4/2017-2018

#### Public Tender No. : NCRA:237 L:PUB363:2017

The National Centre for Radio Astrophysics (NCRA) of the Tata Institute of Fundamental Research (TIFR) is a leading Centre for research in a wide range of areas in astronomy and astrophysics.

1. **NCRA-TIFR**, Pune, India invites sealed bids in two part, Part– I: Techno-commercial Bid & Part – II: Price Bid **from OEMs or their accredited distributors / dealers / agents** for the supply of the following:

Description of Work	Earnest Money Deposit (EMD) INR
Supply, installation, testing and commissioning of 22 TR, 3 Phase, 440 Volts +/- 10% AC 50 Hz, Operated ductable packaged AC unit 8800 CFM AHU with independent refrigerant circuits suitable for – 4 x 5.5 TR outdoor air cooled condenser units and sheet metal ducting inside auditorium. <b>Make: Blue Star / LG/Voltas/Daiken/Carrier.</b>	<b>Rs. 81,000/-</b> (Rupees Eighty One Thousand Only by way of Demand Draft drawn in favour of “TIFR” payable at Pune <b>Cost of Tender Document : Rs. 300/-</b> (Rupees Three Hundred only by way of Demand Draft drawn in favour of “TIFR” payable at Pune.
<b>EMD and Cost of Tender Document must be submitted with Technical Bid.</b>	
Date and Time for submission of Bids	<b>22/01/2018, upto 1800 hrs.</b>
Date and time of opening of Techno Commercial Bid (Part- I).	<b>23/01/2018, at 1500 hrs.</b>

#### 2. Eligibility Criteria:

- a. Bidder must visit the site to know exact scope of work, site conditions etc. and submit certificate of visit as per **Annexure -N** with their bid.
- b. Bidder must be an OEM or an authorized distributor / dealer / Partner of **Blue Star / LG/Voltas/Daiken/Carrier**. Manufacturer Authorisation Certificate as per our Format at **Annexure -C**, must be enclosed with the technical bid, if bid is from a Dealer / Distributor / Partner. **Bids for other makes will not be accepted.**
- c. Bidders can quote only for Single make.
- d. Bid must be valid for a minimum period of **180 days** from the due date for submission of bid.
- e. Bidder must have their service set up at Pune for the past **three years** from the date of this advertisement at Pune for undertaking sales and after sales service of the equipment.
- f. Bidders should submit along-with the quotations the proof of their Experience in carrying out the work of similar nature for supply and installation, testing and successfully commissioning of AC systems at Pune / Mumbai / Narayangaon.

g. Bids from bidders who have not accepted our order awarded to them or who have withdrawn from the tender process OR whose EMD/Security deposit has been forfeited by us or who have failed to execute order placed, on them in the past one year are not eligible to bid.

3. Bidding document can be downloaded from our website <http://www.ncra.tifr.res.in/ncra/ncra1/public-tenders-1> and also on <http://eprocure.gov.in/epublish/app> by any interested bidder meeting the eligibility criteria from December 13, 2017 to January 12, 2018.

Bidders after downloading the tender document are requested to please send an email to [purchase@ncra.tifr.res.in](mailto:purchase@ncra.tifr.res.in) giving their Full address, so that purchase can intimate regarding the correspondence / addendum to the tender documents, if any.

4. Interested Bidders may obtain further details from :

**National Centre for Radio Astrophysics,  
Tata Institute of Fundamental Research,  
NCRA, Post Box No. 3, Ganeshkhind,  
Pune - 411 007. Maharashtra, India.  
Tel - 020-25719266/9206/9000  
Fax - 020-25692149**

**Website : [www.ncra.tifr.res.in](http://www.ncra.tifr.res.in)**

**E-mail : [purchase@ncra.tifr.res.in](mailto:purchase@ncra.tifr.res.in)**

The bids Part 1 – Techno-commercial Bid together with all documents as stated in Check List & Part 2 – Price Bid in separate sealed envelopes duly superscribed with tender no. & due date must reach Purchase Officer, NCRA-TIFR, Pune University Campus, Ganeshkhind, Pune-411007, India. Techno-commercial bid will be opened in the presence of Bidders' representatives who choose to attend on the specified date and time alongwith authority letter from their company. In the event of the date specified for bid receipt and opening being declared as a closed holiday for NCRA's office, the due date for submission of bids and opening of bids will be the following working day at the same time.

5. Price bids will be opened at a later date which will be intimated to only techno-commercially qualified bidders.
6. All bids must be accompanied by **DD towards earnest money deposit and Cost of Tender document** specified above and must be delivered to the above office at the date and time indicated above.
7. NCRA reserves the right to accept or reject any or all bids without assigning any reasons there for.
8. NCRA is not responsible for delay or loss of tender document / bids in transit.
9. **Bidder are also requested to visit our website [www.ncra.tifr.res.in](http://www.ncra.tifr.res.in) regularly for any addendum /updates pertaining to this tender.** No separate notification will be published in the Newspapers for the same.
10. **Bids / Offers by Fax / Email will not be considered.**

Please see attached sheets for conditions of tender.

**PURCHASE OFFICER**



**NATIONAL CENTRE FOR RADIO ASTROPHYSICS**  
**Tata Institute of Fundamental Research**  
**Pune**

**Public Tender No.**

**NCRA:237 L:PUB363:2017**

Supply, installation, testing and commissioning of 22 TR, 3 Phase, 440 Volts +/- 10% AC 50 Hz, Operated ductable packaged AC unit 8800 CFM AHU with independent refrigerant circuits suitable for – 4 x 5.5 TR outdoor air cooled condenser units and sheet metal ducting inside auditorium.

Make: Blue Star / LG/Voltas/Daiken/Carrier.

**CHECK LIST TO BE ENCLOSED WITH TECHNO COMMERCIAL BID**

(Part-I of Tender)

Page 1 of 2

Sr. No.	Particulars	Provide Details	Enclosed
1	Whether EMD enclosed.	D.D.No. .... Dtd.....	Yes / No
2	Company Profile – as per <b>Annexure A</b>		Yes / No
3	Eligibility Criteria Statement duly filled in by bidder <b>Annexure- B</b>		Yes / No
4	Whether authorization certificate from respective Manufacturers for supply of item (if bid is from authorized Distributor or dealer) enclosed – as per <b>Annexure – C</b>		Yes / No
5	Whether Schedule of Experience (list of orders completed and orders on hand ) is submitted duly signed and Stamped as per <b>Annexure – E</b>		Yes / No
6	Whether Schedule of deviation from General & Special Conditions is submitted duly signed and Stamped as per <b>Annexure – F</b>		Yes / No
7	Whether schedule of Technical Deviation is submitted duly signed and stamped as per <b>Annexure-G</b>		Yes / No
8	Bid Form enclosed – <b>Annexure –H</b>		Yes / No
9	Undertaking for Amalgamation/Acquisition - <b>Annexure-K</b>		Yes / No
10	Format of Certificate of Site Visit – <b>Annexure-N</b>		Yes / No
11	Format for furnishing Bank Details for refund of EMD/ making payment – <b>Annexure-O</b>		Yes / No
12	Undertaking that eligible similar works have not been executed by another contractor on back to back basis submitted as per <b>Annexure -P</b> .		Yes / No
13	Undertaking for having read and taken note of all the terms and conditions of the Tender as per <b>Annexure- Q</b> enclosed.		Yes / No

Date : Signature of Bidder :

Name &amp; Designation :

Place : Company Name &amp; Address :

Company Seal &amp; Phone No. :

**CHECK LIST TO BE ENCLOSED WITH TECHNO COMMERCIAL BID**

(Part-I of Tender)

Page 2 of 2

<b>Sr. No.</b>	<b>Particulars</b>	<b>Provide Details</b>	<b>Enclosed</b>
14	Copies of Shop & establishment registration evidencing Pune Office address enclosed.		<b>Yes / No</b>
15	Authorisation to sign the bid enclosed from Competent Authority Enclosed.		<b>Yes / No</b>
16	Partnership registration /Company incorporation Copy enclosed.		<b>Yes / No</b>
17	Copy of power of attorney to sign the bid enclosed(Applicable for LLP / partnership company / PVT LTD / LTD Company)		<b>Yes / No</b>

18	<b>Price bid – Part II - Chapter 7 of tender document to be submitted in a separate sealed envelope.</b>	<b>Yes / No</b>
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Date : Signature of Bidder :

Name & Designation :

Place : Company Name & Address :

Company Seal & Phone No. :

:

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**INSTRUCTIONS TO BIDDER (ITB)**

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## **A - Introduction**

### **1.1 Eligible Bidders**

Bidders who fulfill the pre-qualification/eligibility criteria as specified in our tender notice are only required to submit their bids and will only be considered for technical evaluation.

Issue/downloading of tender document does not mean that a bidder is qualified to submit the bid. Purchasers decision in this regard will be final.

### **1.2 Cost of Bidding**

The Bidder shall bear all costs associated with the preparation and submission of its bid, and "Purchaser", will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

## **B - The Bidding Documents**

### **1.3 Content of Bidding Documents**

The goods required, bidding procedure and contract terms are prescribed in the bidding documents which should be read in conjunction.

The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding documents. Failure to furnish all information required by the bidding documents or submission of a bid not substantially responsive to the bidding documents in every respect will be at the Bidder's risk and may result in rejection of their bid.

### **1.4 Clarification of bidding documents**

A prospective Bidder requiring any clarification of the Bidding Documents shall contact purchaser in writing at purchaser's address specified in the Tender Notice. Purchaser shall forward copies of its response to all those who have acquired the Bidding Documents directly from it, including the query but without identifying its source. Purchaser if deemed necessary will amend the Bidding Documents as a result of a clarification, purchaser shall do so following the procedure under clause relating to amendment of bidding documents and Clause relating to Deadline for Submission of Bids.

### **1.5 Amendment of Bidding Documents**

At any time prior to the deadline for submission of bids, purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bidding documents by amendment.

All prospective bidders who have received the bidding documents will be notified of the amendment in writing or by fax, or by e mail which will be binding on them and the same may also be posted on our website.

In order to allow prospective bidders reasonable time to take the amendment into account, in preparing their bids, purchaser, at its discretion, may extend the deadline for the submission of bids.

## C - Preparation of Bids

### 1.6 Language of Bid

The bid prepared by the Bidder, as well as all correspondence and documents relating to the bid exchanged by the Bidder and purchaser, shall be written in **English language only**.

### 1.7 Bid form and price schedule

The bidder shall complete the Bid Form and the price schedules furnished in the bidding documents.

Discount / Prices as applicable to Non Commercial/ Government Educational and Research Institutes should be quoted as purchaser is a Deemed University and also Public Funded Research Institute. Prices for software should be for academic version,

### 1.8 Bid Prices

Price quoted should be on F.O.R. Destination basis. (i.e. total landed cost including safe delivery at GMRT-NCRA, Khodad, Tal. Junnar, Dist. Pune 410504, in case of Quote for supply in rupees.

**Price must be quoted as applicable to Government Research and Educational Institutes in the prescribed Price Bid Format attached herewith as “Part – II” (Price Bid).**

The Bidder shall indicate on the respective price schedule, the unit prices of the goods & services he proposes to provide under the contract.

“If a bidder quotes NIL charges / consideration, the bid shall be treated as unresponsive and will not be considered”.

### 1.9 **GST : Will be Paid Extra.**

### 1.10 Offer from distributor/dealer on behalf of manufacturer

In case the bid is submitted by distributor/dealer on behalf of OEM, Manufacturer's Authorisation Certificate as per our format, Refer **Annexure – C** must be submitted, failing which bid will be rejected.

### 1.11 Conditional Discount

In case the bidder offer any conditional discount with regard to acceptance of their bid within a specific period or specific payment terms, delivery, quantity etc. the purchaser will not take in to such conditional discount while evaluating their bid.

### 1.12 Bid Currency

Prices shall have to be quoted in Indian Rupees. Bidders have to use our price bid format only for quoting the rates.

### 1.13 Documents Establishing Bidder's Eligibility and qualifications

The bidder shall furnish, as part of their bid, documents establishing the bidder's eligibility to bid and their qualification to perform the contract if their bid is accepted.

The documentary evidence of the bidders' qualification to perform the contract if the bid is accepted and shall establish to purchaser's satisfaction that, the bidder meets the qualification criteria listed in bidding documents, if any.

1.14 *Documents Establishing Goods' Eligibility and Conformity to Bidding Documents*

To establish the goods' eligibility, the documentary evidence of the goods and services eligibility shall consist of a statement on the goods and services offered.

(a) An item-by-item commentary on our Technical Specifications demonstrating substantial responsiveness of the goods and services to those specifications or a statement of deviations and exceptions to the provisions of the Technical Specifications.

For purposes of the commentary to be furnished pursuant to above, the Bidder shall note that standards for workmanship, material and equipment, designated by purchaser in its Technical Specifications are intended to be descriptive only and not restrictive.

1.15 *Period of Validity of Bids*

Bids will have to remain **valid for a minimum of 180 days** from the date of techno commercial bid opening. A bid valid for a shorter period shall be rejected by purchaser as non-responsive.

In exceptional circumstances, purchaser may solicit the Bidder's consent to an extension of the period of validity. The request and the responses thereto shall be made in writing (by fax or e-mail). The EMD provided shall also be suitably extended.

A Bidder may refuse the request without forfeiting their EMD. A Bidder accepting the request will not be required nor permitted to modify their bid.

Bid evaluation will be based on the bid prices without taking into consideration the above corrections.

1.16 *Format and Signing of Bid*

The bids are to be submitted in two parts as specified in the Tender Notice.

The Bidder shall submit the bids in two parts. First part (Part – I) shall contain Techno commercial bid comprising all documents listed in the Check List, including technical specifications, bill of materials & Drawings, taxes and duties payable, delivery period and validity.

The second part (Part – II) shall contain only the price-bid comprising price schedules with prices.

The bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to bind the Bidder to the Contract. All pages of the bid, except for un-amended printed literature, shall be initialed by the person or persons signing

the bid.

Any inter lineations, erasures or overwriting shall be valid only if they are initialed by the person or persons signing the bid.

1.17 *Status of Individual signing the offer*

Individuals signing the bid form and other connected documents must specify the capacity in which they sign like :

- (a) Whether signing as a Sole proprietor of the firm.
- (b) Whether signing as a partner of the firm.
- (c) Whether signing for the firm as Agent.
- (d) Whether signing as a director of a private/limited company. Power of attorney to sign the bid to be submitted in case of b, c & d.

## **D - Submission and sealing of Bids**

### **1.18 Submission, Sealing and Marking of Bids**

Bidders are advised to inspect and examine before submitting their bid the following which may influence or affect their bid.

- (a) Nature of Site.
- (b) Access to Site.
- (c) Space and facilities required.
- (d) Loading, unloading and facilities for shifting of items.
- (e) All other necessary information, risks, contingencies and other circumstances.

Submission of bid by a bidder implies that he has studied the tender documents and has made himself aware of the scope and specifications with all its conditions and other factors.

The bidders may submit their duly sealed bids by post/courier. Purchaser will not be responsible for any misplacement/delay/ loss of tender documents & bids in transit. Bidder can also drop the bid in person in the public tender box kept at the reception counter of purchaser after entering the requisite details in the Public Tender Register kept with the Security Supervisor.

Bids are to be submitted in two parts in separate sealed envelopes specifying tender no. Part-I – Techno-Commercial Bid & Part-II – Price Bid. Both the envelopes must be sent in another sealed cover duly superscribing our tender no., due date and name of the Bidder so as to reach us on or before the due date & time and to be submitted to the address given below :

**Purchase Officer,  
National Centre for Radio Astrophysics,  
Tata Institute of Fundamental Research,  
Post Box No. 3, Ganeshkhind,  
Pune - 411 007. Maharashtra, India.**

**Envelope No. 1: Shall contain “Techno-commercial Bid” (with all the documents listed in Check List) alongwith DD towards Earnest Money Deposit (EMD) and tender fee.**

**Envelope No. 2: Shall contain only “Price Bid” containing price schedule with prices.**

The techno commercial offer **should NOT contain any price information.** It must be submitted in an organized and structured manner. No brochures/leaflets etc. should be submitted in loose form. Please indicate page nos. on your bids, eg. If the bids are containing 25 Pages, please indicate page nos. as 1/25, 2/25, 3/25 -----25/25.

**Bids, which are submitted without following sealed two bid system, will be summarily rejected.**

The techno commercial bid should contain all commercial terms (except prices) with reference to the bid including drawings.

The techno commercial bid should be complete to indicate that all products and services asked for are quoted. Each page of the bid and cutting/corrections shall be duly signed and stamped by the bidder. **Unsigned bid will be rejected.** Failure to comply with this requirement may result in rejection of the bid.

If the envelope is not sealed and marked as required above, purchaser will assume no responsibility for the bid's misplacement or premature opening and in such cases bids will get rejected.

1.19 *Requirement of Tender Submission*

Bidder must have to bid for all items in the price bid failing which their bids will not be considered. Details of options and accessories for which rates are quoted to be specified in the technical.

The techno-commercial bid should have sufficient details to show point wise compliance to the specifications and shall include a full set of descriptive technical literature of the equipment and system proposed.

The system is to be installed at purchaser's site. For site inspection before submission of tender, the bidder may contact **Shri B.S. Patil / Shri R.V. Swami at NCRA-TIFR, Pune Phone No. 02132-258400 / 300**

**Email : [balaso@gmrt.ncra.tifr.res.in](mailto:balaso@gmrt.ncra.tifr.res.in), [swami@gmrt.ncra.tifr.res.in](mailto:swami@gmrt.ncra.tifr.res.in)**

In case the required system is not in the range of manufacturing of the bidder or the bidder is not interested to participate in the Tender bidder may send a REGRET letter.

1.20 *BID SUBMISSION :*

**In Rupees only with GST extra.**

1.21 *Deadline for Submission of Bids*

Bids must reach Purchase officer, NCRA-TIFR, Pune at the address specified in Tender Notice not later than the time and date specified herein. In the event of the specified date for the submission of Bids being declared a holiday for purchaser, the Bids will be received upto the appointed time on the next working day.

Purchaser may, at its discretion, extend the deadline for submission of bids by amending the bid documents in accordance with Clause relating to amendment of bidding Documents in which case all rights and obligations of purchaser and bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

1.22 Late Bids

Any bid received by purchaser after the deadline for submission of bids prescribed will be rejected.

Such tenders shall be marked as late and not considered for further evaluation. They shall not be opened at all and will be returned to the bidders in their original envelope without opening.

1.23 **ACCEPTANCE OF BID** : Institute shall be under no obligation to accept the lowest or any other bid received in response to this tender and shall be entitled to reject any or all bids without assigning any reason whatsoever.



## E - Opening and Evaluation of Bids

### 1.24 Opening of Bids

Purchaser will open techno commercial bids one at a time in the presence of Bidder's authorized representatives who choose to attend, as per the schedule given in Tender Notice. The Bidders' representatives who are present shall sign the bids opening sheet evidencing their attendance. In the event of the specified date of bid opening being declared a holiday for purchaser, the Bids shall be opened at the appointed time and location on the next working day. The Price bids shall be opened only after technical evaluation & the date for the same will be intimated to technically qualified bidders at a later date.

The bidders names and the presence or absence of requisite EMD and such other details as purchaser, at its discretion, may consider appropriate, will be announced during the opening.

a) Bids that are received late shall not be considered further for evaluation, irrespective of the circumstances.

**b) Bidders interested in participating for bid opening, should depute their representatives along with an authority letter to be submitted to purchaser at the time of bid opening.**

c) Only one representative of each bidder will be permitted during opening of bids.

### 1.25 Clarification of Bids

To assist in the examination, evaluation, comparison and post qualification of the bids, purchaser may, at its discretion, ask the Bidder for a clarification on their bid. The request for clarification and the response shall be in writing and no change in prices or substance of the bid shall be sought, offered or permitted. However, no negotiation in respect of prices shall be held except with the lowest bidder, at the discretion of purchaser. Any clarification submitted by a bidder in respect to their bid which is not in response to a request by purchaser shall not be considered.

### 1.26 Preliminary Examination

Purchaser shall examine the bids to confirm that all documents and technical documentation requested have been provided to determine the completeness of each document submitted.

Purchaser shall confirm that the following documents and information have been provided in the Bid. If any of these documents or information is missing, the offer shall be rejected.

(a) Bid Form and Price Schedule;

(b) All the bids received will first be scrutinized to see whether the bids meet the basic requirements as incorporated in the bid document. The bids, which do not meet basic requirements, will be treated as unresponsive and ignored. ***The following are some of the important points, for which a bid will be declared as unresponsive and will not be considered for further evaluation:***

(i) The Bid is unsigned.

(ii) The Bidder is not eligible.

(iii) The Bid validity is shorter than the required period.

(iv) The Bidder has quoted for goods manufactured by a different firm other than what has

- been specified in the tender document.
- (v) Bidder has not agreed to give the required security deposit & Performance Guarantee.
  - (vi) The goods quoted are sub-standard, not meeting the required specification etc.
  - (vii) Against the schedule of Requirement (incorporated in the bid), the bidder has not quoted for the entire requirement as specified in that schedule.
  - (viii) The bidder has not agreed to some essential condition(s) incorporated in the bid.

1.27 Responsiveness of Bids

Prior to the detailed evaluation, purchaser will determine the substantial responsiveness of each bid to the bidding documents. For purposes of this clause, a substantive responsive bid is one, which conforms to all terms and condition of the bidding documents without material deviations, reservations or omissions. A material deviation, reservation or omission is one that:

- (a) Affects in any substantial way the scope, quality, or performance of the Goods and Related Services specified in the Contract; or
- (b) Limits in any substantial way, inconsistent with the Bidding Documents, purchaser's rights or the Bidder's obligations under the Contract; or
- (c) If rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

Purchaser's determination of a bid's responsiveness will be based on the contents of the bid itself.

If a bid is not substantially responsive, it will be rejected by purchaser and may not subsequently be made responsive by the bidder by correction of the material deviation, reservation or omission.

1.28 Non-Conformity, Error and Omission

Provided that a bid is substantially responsive, purchaser may waive any nonconformity or omissions in the bid that do not constitute a material deviation.

Provided that a bid is substantially responsive, purchaser may request the bidder to submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformity or omissions in the bid related to documentation requirements. Such omission shall not be related to any aspect of the price of the bid. Failure of the Bidder to comply with the request may result in the rejection of their bid.

Provided that the bid is substantially responsive, purchaser shall correct arithmetical errors on the following basis:

- (a) If there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected;
- (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

Provided that a bid is substantially responsive, purchaser may request that a bidder may confirm the correctness of arithmetic errors as done by purchaser within a target date. In case, no reply is received then the bid submitted shall be ignored and its **Earnest Money** will be forfeited.

If the price for an item with same part no. is quoted differently at different place, lower rate will be taken as the price of the item.

In the event no rate has been quoted in words or figures for any item/items it will be presumed that the contractor/supplier has included the cost of this/these item/items in other item and rate for such item/items will be considered as zero & supply/work will be required to be executed accordingly.

In case of any tender where unit rate of any item/items quoted is unrealistic, such a tender is liable to be disqualified & rejected.

1.29 Examination of Terms & Conditions, Technical Evaluation

Purchaser shall examine the Bid to confirm that all terms and conditions specified in the bid document have been accepted by the Bidder without any material deviation or reservation.

Purchaser shall evaluate the technical aspects of the Bid submitted to confirm that all requirements specified in Schedule of Requirements of the Bidding Documents have been met without any material deviation or reservation.

1.30 Evaluation and comparison of bids

Purchaser shall evaluate each bid that has been determined, up to this stage of the evaluation, to be substantially responsive.

To evaluate a Bid, purchaser shall only use all the factors, methodologies and criteria defined in the bid documents.

The price bids shall be evaluated on the basis of final landing cost which will be calculated as under to bring quotes on equal footing including installation, commissioning and testing charges at destination.

**Landing Cost in respect of offer for indigenous items will be arrived as under :-**

- (a) Basic price quoted, less discount, if any.
- (b) Add cost of accessories/spares, if any.
- (c) Add packing charges, if any.
- (d) Add Customs Duty (applicable) on (a).
- (e) Add safe delivery charges, if any.
- (f) GST as applicable on (a) to (e).

(In case the offer is ex.works and the bidder has not specified the packing, forwarding and transportation charges separately, please add 2% of the basic price towards packing (both local and outstation firm) and 1% of the basic price towards safe delivery charges in respect of local firm and 3% of the basic price towards safe delivery charges in respect of outstation firm).

- (g) Add training / testing charges, any other charges quoted by the firm.
- (h) Add erection and commissioning charges (if any).
- (i) Add GST on g and h.
- (j) Add interest on advance @ 12%, if any, asked for by the bidder.

(k) Total landed cost = a+b+c+d+e+f+g+h+i+j

The GCC and the SCC shall specify the mode of transport.

Past Performance :

(a) In case the past performance of the tenderer is not found to be satisfactory with regard to quality, delivery, warranty obligation and non-fulfillment of terms and conditions of the contract, their offer is liable to be rejected by the purchaser.

1.31 Contacting Purchaser

Any effort by a Bidder to influence purchaser in its decisions on bid evaluation, bid comparison or contract award may result in rejection of their bid.

1.32 Post qualification

In the absence of pre-qualification, purchaser will determine to its satisfaction whether the bidder/bidders who is/are selected as having submitted the lowest evaluated responsive bid is qualified to perform the contract satisfactorily, in accordance with the bid document.

The determination will take into account the eligibility criteria listed in the bidding documents and will be based upon an examination of the documentary evidence of the bidder's qualifications submitted by the bidder, as well as such other information as purchaser deems necessary and appropriate.

An affirmative determination will be a prerequisite for award of the contract to the bidder. A negative determination will result in rejection of the bidder's bid.

## **F- Award of Contract**

### 1.33 Negotiations

There shall not be any negotiation normally. Negotiations shall be held with the lowest evaluated responsive bidder if required. Counter offers tantamount to negotiations and shall be treated at par with negotiations in the case of one time purchases.

### 1.34 Award Criteria

Purchaser will award the contract to the successful Bidder whose bid has been determined to be substantially responsive and has been determined to be the lowest evaluated bid.

### 1.35 Purchaser's right to divide/vary the Quantities at the time of Award

Purchaser reserves the right at the time of Contract award to decrease the quantity of goods and services originally specified in the Schedule of Requirements without any change in unit price or other terms and conditions. Further, the purchaser may also divide the quantity and place orders on two or more suppliers. Purchaser also reserves the right to place or not to place order for Spares/accessories.

### 1.36 Purchaser's right to accept Any Bid and to reject any or all Bids

The Centre Director, NCRA reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders.

### 1.37 Notification of Award

Prior to the expiration of the period of bid validity, purchaser may notify the successful bidder in writing by registered letter or fax or e mail that the bid has been accepted and a separate work order shall follow.

Until a formal order is prepared and sent, the notification of award should constitute a binding contract.

Upon placing order on successful Bidder's, purchaser will release the **Earnest Money** to all unsuccessful bidders.

### 1.38 Order Acceptance

The successful bidder should submit Order acceptance **within 15 days** from the date of issue, failing which it shall be presumed that the bidder is not interested and their **Earnest Money** will be forfeited.

Purchaser has the powers to extend the time frame for submission of order confirmation and submission of Security deposit. Even after extension of time, if the order confirmation and security deposit are not received, the contract may be cancelled and limited tenders irrespective of the value shall be invited from the responding firms after forfeiting the **Earnest Money** of the defaulting firm, where applicable, provided there is no change in specifications. In such cases the defaulting firm shall not be considered again for re-tendering.

1.39 OTHER TERMS AND CONDITIONS

- A. Safety & Security : Contractor will be responsible for the safety and security of all their workmen and staff and will ensure to maintain necessary records for payment and other details as per the prevailing Procedures and Acts. You will be fully responsible for any personal injury, accident, death of your personnel and shall take proper precautions against any such loss or damages while execution of the contract.
- B. Deployment of Labour & Machinery : You shall not employ any person who has not attained the age of 18 years. You shall deploy sufficient equipment's and labour as may be necessary to maintain the progress of schedule. Night work which requires supervision shall not be permitted except when specially allowed by Engineer each time. On your request, you will be provided necessary lighting arrangements etc. for night work as directed by Engineer.
- C. Work at Night or on Holidays : No work at night or on legal holidays will be carried without the written consent of the Engineer and if permitted such work to be done in the presence of the Engineer or his representative.
- D. Demobilisation / Site Clearance : On completion of works under this contract, you shall clear up the site and remove from the site all surplus materials, equipment's, debris, centering etc. and shall handover the site to us in a condition satisfactory to the Engineer
- E. Storage of tools and materials: You shall make your own arrangement for storage safety of tools, plants, machinery, materials & necessary arrangement for labour also.
- F. Payment of extra work: You shall carry out the execution of the items which are not covered up under this contract only after obtaining the written order from Engineer. The Engineer shall decide and fix the rates of the extra items with the help of the schedule of rates of the department. No extension of time limit shall be granted due to execution of the extra items unless the same is recommended by the Engineer.
- G. Protection of property: You shall be responsible for making good to the damages to the existing property. During the execution of work, it is likely that you may come across telephone cables, electrical cables, water supply lines, Lan cable etc., it will, therefore, be your responsibility to protect them carefully. All such cases should be brought to the notice of the Engineer by you and also to the concerned department. Any damage whatsoever done to these are be made good by you at your own cost.
- H. Method of measurement : The measurements/weight of all the items under this contract shall be taken by our Engineer as per standard practice and shall be net dimensions as existing on the site. The measurement/weight will be joint measurements/weight and in case you neglect to remain present while such measurements are being taken by Engineer, the measurements/weight taken and approved by Engineer shall be treated as correct and final.

## **CHAPTER 2**

### **GENERAL CONDITIONS OF CONTRACT (GCC)**

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The following words and expressions shall have the meanings hereby assigned to them:

- a. "Contract/purchase order/work order" means the order placed by purchaser on the Supplier, together with the Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein.
- b. "Contract Documents" means the documents listed in the work order, including any amendments thereto.
- c. "Contract Price" means the price payable to the Supplier as specified in the contract, subject to such additions and adjustments thereto or deductions there from, as may be made pursuant to the Contract.
- d. "Day" means calendar day.
- e. "Completion" means the fulfillment of the Related Services by the Supplier in accordance with the terms and conditions set forth in the Contract.
- f. "GCC" means the General Conditions of Contract.
- g. "Related Services" means the services incidental to the supply of the goods, such as transportation, insurance, installation, configuration, training and initial maintenance and other such obligations of the Supplier under the Contract.
- h. "SCC" means the Special Conditions of Contract.
- i. "Subcontractor/sub vendor/sub fabricator" means any natural person, private or government entity, or a combination of the above, to whom any part of the Goods to be supplied or execution of any part of the Related Services is subcontracted by the Supplier & shall include his heirs, legal representatives, successors and permitted assigns.
- j. "BoM" means bill of material.
- k. 'Centre Director' shall mean Center Director, NCRA-TIFR, Pune & shall include his successor and assigns, as well as his authorized officers/ representatives
- l. 'Engineer' shall mean the engineer/representative of the owner/ purchaser.
- m. 'Bidder / Tenderer' shall mean the firm/ party who bids against an enquiry / tender.
- n. 'Vendor/ Contractor/ Fabricator/Supplier' shall mean the successful BIDDER whose bid has been accepted by the owner/ purchaser and on whom the 'Contract' or 'Purchase Order' is placed by the owner/purchaser and shall include his heirs, legal representatives, successors and permitted assigns.
- o. 'Manufacturer' refers to a person or firm who is the producer and furnisher of material or designer and fabricator of equipment to either the owner/ purchaser or the vendor/ contractor or both under the contract.
- p. 'Others' shall mean other successful bidders whose bids have been accepted by the owner/ purchaser and shall include their heirs, legal representatives, successors and permitted assigns.
- q. Owner / Purchaser / Cente / Institute mean NCRA-TIFR Pune.
- r. 'Inspector' shall mean the authorized representatives appointed by the owner/ purchaser for purposes of the inspection of materials/ equipment/ works.
- s. 'Site' shall mean the actual place of the proposed work as detailed in the specification or other place where work has to be executed under the contract or item to be supplied.
- t. 'Month' shall mean calendar month.
- u. 'Specification' shall mean collectively all the terms and stipulations contained in those portions of the 'Contract' known as General Conditions, the Specifications and such Amendments, Revisions, Deletions or Additions, as may be made in the Agreement and all written Agreements made or to be made pertaining to the method and manner of performing the Work or to the quantities and qualities of the materials to be furnished under this 'Contract'.



- v. 'Bid' shall mean the proposal/ document that the BIDDER submits in the requested and specified form in the 'Specification'.
- w. 'Item' 'Items' 'Goods' 'Stores' Plant' or 'Equipment' and 'Work' or 'Works' shall mean respectively the goods to be supplied and services to be provided by the vendor/ contractor/ fabricator under the 'Purchase Order' or 'Contract'.
- x. 'Date of Contract' shall mean the calendar date on which the owner/ purchaser and vendor/ contractor/ fabricator have signed the 'Contract'. 'Effective Date of Contract' shall mean the calendar date on which the owner/ purchaser have issued to the vendor the 'Letter of Intent' or three months prior to the 'Date of Contract' or six months prior to the date of issue of import license whichever is later or as otherwise mutually agreed to between the owner/ purchaser and the vendor.
- y. 'Contract Period' shall mean the period during which the 'Contract' shall be executed as agreed between vendor/ contractor/ fabricator and owner/ purchaser in the 'Contract'.
- z. 'Warranty' / 'Guarantee Period' shall mean the period during which the 'Plant' or 'Equipment' shall give the same performance as guaranteed by the vendor in the Schedule of Guarantee as in the 'Specification'.
- aa. 'Approved' and 'Approval' where used in the 'Specification' shall mean respectively approved by and approval of the owner/ purchaser.
- bb. When the words 'approved', 'approval', 'subject to approval', 'satisfactory', 'equal to', 'proper', 'requested', 'as directed', 'where directed', 'when directed', 'determined', 'accepted', 'permitted', or words and phrases of like import are used, the approval, judgment, direction etc. is understood to be a function of the owner/ purchaser.
- cc. 'Engineer's Instructions' shall mean any drawings and / or instructions oral and/ or in writing, details representative of the owner/ purchaser from time to time during the 'contract period'.
- dd. 'Writing' shall include any manuscript, typewritten or printed statement, under or over signature and/ or seal as the case may be.
- ee. "Notice in Writing" or 'Written Notice' shall mean a notice in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have received when the ordinary course of post it would have been delivered.
- ff. 'Contractor's Works' or 'Manufacturer's Works' shall mean and include the land and the other places which are used by the Vendor/ Contractor/ Fabricator or Sub-vendor/ Sub-contractor/ Sub-fabricator for the manufacture of the 'Equipment ' or performing the 'Works'.
- gg. 'Commissioning' shall mean integrated activity covered under 'Preliminary Operation', 'Trial Operation' and carrying out 'Performance Tests'.
- hh. 'Trial Operation' shall mean the integrated operation of the Plant, system/ Equipment covered under the 'Contract' for a specified period at a specified load for providing trouble-free operation of the Plant/ system/ Equipment covered under the 'Contract'.
- ii. 'Performance Tests' shall mean such tests as are prescribed in the 'Specification', to be done by the vendor before the Plant is taken over under guarantee by the owner/ purchaser.
- jj. 'Virtual Completion' shall mean that all Work is completed as directed and the 'Site' is cleared to the satisfaction of the owner/ purchaser.
- kk. 'Commercial Use' shall mean that use of the 'Equipment' or 'Work' which the 'Contract' contemplates or that for which 'Equipment' or 'Work' is commercially capable.
- ll. 'Minor Modification' as applied to equipment erection contracts only, shall mean the modification work required to be done on the 'Equipment' or 'Work' which need a maximum of 48 man-hours per item of work. In the case of civil contracts, it shall be 'Works' which need a maximum of 8 man-hours per item of work.

mm. 'Major Modification' as applied to equipment erection contracts only, shall mean the modification work required to be done on the 'Equipment' and 'Works' needing more than 48 man-hours per item of work, where such work is required to be done for no fault of the Vendor/ Contractor. In the case of work contracts, it shall be 'Works' needing more than 8 man-hours per item of work.

2.2 Amalgamation/Acquisition

In the event the Manufacturer/Supplier proposes for amalgamation, acquisition or sale of its business to any firm during the contract period, the Buyer/Successor of the Principal Company are liable for execution of the contract and also fulfillment of contractual obligations i.e. supply, installation, commissioning, configuration, warranty, maintenance/replacement of spares accessories etc. while submitting your bid, Bidders need to confirm the same in writing.

2.3 Suppliers' Responsibilities

The Supplier shall supply all the Goods and Related Services included in the BoM, and the Delivery and Completion schedule. Supply means : "Supply, Schedule, as per GCC Clause relating to delivery and document. Design, Installation, testing, Commissioning and satisfactory demonstration of the whole system and training & providing after sales services during warranty period". Charges payable for the same should be specified in the price bid.

2.4 Contract price

Prices charged by the Supplier for the Goods supplied and the Related Services performed under the Contract shall be firm.

2.5 Copy Right

The copyright in all drawings, documents, and other materials containing data and information furnished to purchaser by the Supplier herein shall remain vested in the Supplier, or, if they are furnished to purchaser directly or through the Supplier by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

2.6 Application

These General Conditions shall apply to the extent that they are not superseded by provisions in other parts of the Contract.

2.7 Standards

The Goods supplied and services rendered under this Contract shall conform to the standards mentioned in the Technical Specifications and Schedule of Requirements, and, when no applicable standard is mentioned, to the authoritative standard appropriate to the Goods' country of origin and such standards shall be the latest issued by the concerned institution.

## 2.8 Patent/design/copy right/trade mark Indemnity

The Supplier shall indemnify and hold harmless purchaser and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney's fees and expenses, which purchaser may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Goods by the Supplier or the use of the Goods in India; and (b) the sale in any country of the products produced by the Goods.

If any proceedings are brought or any claim is made against purchaser, purchaser shall promptly give the Supplier a notice thereof, and the Supplier may at its own expense and in the purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

## 2.9 Packing

The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights permissible under existing road/rail/sea limitations and shall take into consideration, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

The packing, marking and documentation within and outside the packages shall comply strictly with such special requirements as shall be provided for in the Contract including additional requirements, if any, specified in SCC and in any subsequent instructions given by purchaser.

Even when no packing specification is included it will be suppliers responsibility to provide appropriate packing depending upon the nature of the supply and the transportation and handling hazards.

The equipment shall be so packed and protected as not to suffer deterioration, damage or breakage during shipment and storage in a tropical climate.

Each package shall be properly labeled to indicate the type and quantity of material it contains, the purchase order number its dimensions and weights and any other necessary data to identify the equipment and relate it to contract. Packing slip containing description of item & qty. must be affixed on the box.

Empty packages / packing material will become property of the owner.

If wood has been used for packing, Fumigation certificate to be provided with the shipment.

## 2.10 Delivery of items

Supplier/manufacturer will have to deliver the item/s at delivery point specified in SCC.

2.11 Duration for Completion of contract.

The items will have to be supplied within the period specified in the SCC.

2.12 Incidental Services

The supplier may be required to provide any or all of the services, if any, specified in SCC.

2.13 Despatch Documents

A The following documents in original are to be sent to Purchaser.

- a. Full set of invoice showing Quantity and Amount.
- b. Packing slip indicating no. of packages, gross and net weight.
- c. Manufacturers internal test, inspection certificates.
- d. Soft copy of user / instruction installation manuals in English.
- e. Inspection certificate issued by the Purchaser's Inspector, if any;
- f. Guarantee/Warranty certificates issued by Original Equipment Manufacturer.
- g. Fumigation Certificate if wood is used in packing.

B The following documents are to be handed over to the carrier / transporter while handing over the item.

- a. Three Sets of Invoice.
- b. Two Sets of packing slip.
- c. Fumigation Certificate if wood has been used in packing.

2.14 Assignment

The Supplier shall not assign, in whole or in part, its obligations to perform under the Contract to third party, except with purchaser's prior written consent.

2.15 Extension of time

Delivery of the Goods and performance of the Services shall be made by the Supplier in accordance with the time schedule specified by purchaser.

If at any time during performance of the Contract, the Supplier or its sub-contractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, the Supplier shall promptly notify purchaser in writing the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Supplier's notice, purchaser shall evaluate the situation and may, at its discretion, extend the Supplier's time for performance with or without penalty, in which case the extension shall be ratified by the parties by amendment of the Contract.

Except as provided under the Force Majeure clause of the GCC, a delay by the Supplier in the performance of its delivery obligations shall render the Supplier liable to the imposition of liquidated damages unless an extension of time is agreed upon pursuant to above clause without the application of liquidated damages clause.

## 2.16 Termination for Default

Purchaser may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or part

- (a) If the Supplier fails to deliver any or all of the Goods within the period(s) specified in the contract, or within any extension thereof granted by purchaser; or
- (b) If the Supplier fails to perform any other obligation(s) under the Contract.
- (c) If the Supplier, in the judgment of purchaser has engaged in corrupt or fraudulent or collusive or coercive practices as defined in instruction to bidder on Fraud or Corruption in competing for or in executing the Contract.

In the event Purchaser terminates the contract in whole or in part, it may take recourse to any one or more of the following action:

- a) Forfeiting Security deposit;
- b) Purchaser may procure, upon such terms and in such manner as it deems appropriate, item / equipment similar to those undelivered, and the supplier shall be liable for all available actions against it in terms of the contract.
- c) However, the supplier shall continue to perform the contract to the extent not terminated.

## 2.17 Force Majeure

Notwithstanding the provisions of GCC Clauses relating to extension of time, penalty and termination for default, Supplier shall not be liable for forfeiture of their Security deposit, liquidated damages or termination for default, if and to the extent that, its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

For purposes of this Clause, “Force Majeure” means an event or situation beyond the control of the Supplier that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Supplier. Such events may include, but not be limited to, acts of purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, earthquakes, storms and freight embargoes.

If a Force Majeure situation arises, the Supplier shall promptly notify purchaser in writing of such conditions and the cause thereof within 21 days of its occurrence. Unless otherwise directed by purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

If the performance in whole or in part or any obligations under the contract is prevented or delayed by any reason of force majeure for a period exceeding 60 days, either party may at its option terminate the contract without any financial repercussions on either side.

## 2.18 Termination for Insolvency

Purchaser may at any time terminate the Contract by giving written notice to the Supplier, if the Supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the Supplier, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to purchaser.

2.19 Termination for Convenience

Purchaser, by written notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time. The notice of termination shall specify that termination is for the purchaser's convenience, the extent to which performance of the Supplier under the Contract is terminated, and the date upon which such termination becomes effective.

The Goods that are complete and ready for shipment within 30 days after the Supplier's receipt of notice of termination shall be accepted by purchaser at the Contract terms and prices. For the remaining Goods, purchaser may elect:

- (a) To have any portion completed and delivered at the Contract terms and prices; and/or
- (b) To cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and for materials and parts previously procured by the Supplier.

2.20 Discrepancies & Order of Preferences:

In case of ambiguities or discrepancies following order of preferences shall hold good :

- a. Purchase Order.
- b. Technical Specifications
- c. Special Conditions of contract.
- d. General Conditions of Contract.

2.21 Governing Language

The contract shall be written in English language which shall govern its interpretation. All correspondence and other documents pertaining to the Contract, which are exchanged by the parties, shall be written in the English language only.

2.22 Applicable Law/Jurisdiction

The Contract shall be interpreted in accordance with the laws of the Union of India and all disputes shall be subject to place of jurisdiction as specified in SCC.

2.23 Notices

Any notice given by one party to the other pursuant to this contract/order shall be sent to the other party in writing or by e-mail or confirmed in writing to the other party's address specified in the SCC.

A notice shall be effective when delivered or on the notice's effective date, whichever is later.

2.24 Right to use Defective Goods

If after delivery, acceptance and installation and within the guarantee and warranty period, the operation or use of the goods proves to be unsatisfactory, purchaser shall have the right to continue to operate or use such goods until rectifications of defects, errors or omissions by repair or by partial or complete replacement is made without interfering with purchaser's operation.

2.25 Materials

All goods or materials shall be supplied strictly in accordance with the specifications stated in the purchase order or change orders issued by the purchaser.

All goods or materials supplied or used shall be new and of first quality should not be obsolete & going to be obsolete. Where foreign or partly foreign goods or materials are offered or intended to be used, the fact must be specifically stated and brought to the notice of the purchaser.

2.26 Waiver

Purchaser shall be at liberty to waive any breach of any terms or conditions or warranty. Waiver by purchaser or a breach by vendor or any provision of the order shall not be deemed a waiver of future compliance therewith and such provision shall remain in full force and effect.

2.27 Purchaser's Comments

Vendor shall not be relieved of his obligations under the order, including but not limited to his warranty obligations stated herein by incorporating Purchaser's design and fabrication comments into the goods ordered hereunder.

2.28 Responsibility of Vendor

Upon oral or written notification of defects in or malfunctioning of the goods during normal operation, which require corrective action, vendor shall send the necessary personnel to job site to supervise and assume responsibility for repairs and/ or replacement, if necessary of the defective goods or material. If vendor does not expeditiously take steps to correct the breach, purchaser may do so at the cost and expenses incurred by purchaser to repair or replace malfunctioning or nonconforming goods.

Equipment, items or components repaired or replaced by vendor shall have warranty till completion of one year from the date of installation of the equipment.

2.29 Settlement of Disputes.

Purchaser and the supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

If, after twenty-one (21) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either purchaser or the Supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Any dispute or difference in respect of which a notice of intention to commence arbitration has been given in accordance with this Clause shall be finally settled by arbitration. Arbitration may be commenced prior to or after delivery of the Goods under the Contract.

The dispute settlement mechanism/arbitration proceedings shall be concluded as under:  
(a) In case of Dispute or difference arising between purchaser and supplier relating to any

matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Indian Arbitration & Conciliation Act, 1996, the rules there under and any statutory modifications or re-enactments thereof shall apply to the arbitration proceedings. The dispute shall be referred to the sole arbitrator mutually acceptable to supplier and owner. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to this order.

The venue of the arbitration shall be the place from where the purchase order or contract is issued.



## **CHAPTER 3**

### **SPECIAL CONDITIONS OF CONTRACT (SCC)**

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## Chapter 3

### SPECIAL CONDITIONS OF CONTRACT

The following Special Conditions of Contract (SCC) shall supplement and / or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

3.1 *The Purchaser is:*

**National Centre for Radio Astrophysics  
Tata Institute of Fundamental Research  
Pune University Campus, Ganeshkhind,  
Pune - 411007, Maharashtra, India  
Phone : +91 20 2571 9000/9111  
Fax : +91 20 25692149  
E-mail : [purchase@ncra.tifr.res.in](mailto:purchase@ncra.tifr.res.in)**

3.2 *Address where goods are to be delivered and installed is ;*

**Multipurpose Building.  
Gaint Metrewave Radio Telescope (GMRT) - Office,  
National Centre for Radio Astrophysics  
Khodad, Near Narayangaon, Tal-Junnar,  
Dist- Pune, Maharashtra, India  
Tel. 02132-258400 / 300**

3.3 *Scope of Work*

Supply of items as specified in **Chapter –4** of this tender document.

The supplier shall have to depute their specialist to purchaser site at no extra cost during the Warranty period for (a) attending to faults, (b) providing on-job training to personnel in operation, trouble shooting and maintenance (c) attending to commissioning related issues and (d) programming of software etc. (e) providing after sales service.

3.4 *Earnest Money Deposit (EMD)*

Earnest Money Deposit is obtained to ensure the earnestness of the tenderer in the participation of the tender and as a deterrent against the tenderer withdrawing or altering his bids during the bid validity.

Quantum of Earnest Money Deposit

Earnest Money Deposit of **Rs. 81,000/-** to be submitted.

Form of Earnest Money Deposit

In the form of Demand Draft drawn in favour of “TIFR” payable at Pune.

Rejection of Tenders not Accompanied with Earnest Money Deposit

Tenders/offers from the tenderers not accompanied with Earnest Money Deposit, as

demand, will be rejected summarily.

#### Refund of Earnest Money Deposit

- (i) Earnest Money Deposit of other unsuccessful tenderers except the successful bidder will be returned after award of the contract. EMD of the successful bidder will be released on receipt of Security Deposit as per **Caluse No.3.5**, No interest will be payable in case of delay.
- (ii) EMD of bidder who are not technically qualified will be released on receipt of Technical Evaluation Report.

#### The Earnest Money Deposit will be forfeited:

(a) If a Bidder withdraws or amends or impairs or derogates its bid during the period of bid validity specified by the Bidder on the Bid Form; or

(b) In case of a successful Bidder, if the Bidder fails to furnish order acceptance within 15 days of the order or fails to furnish Security deposit within 21 days from the date of order or before the extended date.

### 3.5

#### Security Deposit

Security Deposit to be furnished by the successful bidder within **21 days** of the order for satisfactory performance of the contract. "Satisfactory performance of the contract here means acceptance of the material in respect of supply contracts and satisfactory completion of installation & commissioning and issue of acceptance certificate.

#### Quantum of Security Deposit

Security Deposit shall be for an amount of **Ten Percentage (10%)** of the contract value Including all taxes and duties.

#### Forms of Security Deposit :

Security Deposit can be in the form of Demand Draft in favour of "TIFR" payable at Pune OR Bank Guarantee (BG) in favour of Centre Director, NCRA-TIFR, Pune as per the prescribed format. The Bank Guarantee should be from any one of the nationalized banks or Scheduled banks and executed on non-judicial stamp paper of appropriate value. The BG should be valid upto at least 2 months beyond the contractual date for completion of the order.

In case the successful bidder expresses inability to obtain the Bank Guarantee, the Security Deposit can also be accepted in the form of Demand Draft/Banker's Cheque issued by any one of the Scheduled Bank drawn in favour of "TIFR" payable at Pune.

#### Refund of Security Deposit

Security Deposit is taken for the due performance of the Contract and become liable to be refunded when the Contractor has duly performed and completed the Contract in all respect.

The proceeds of the security deposit shall be payable to purchaser as compensation for any loss resulting from the Supplier's failure to execute the order.

The security deposit will be discharged by purchaser and returned to the Supplier after completion of the contract.

In the event of any contract amendment, the supplier shall, **within 21 days** of receipt of such amendment, furnish the amendment to the security deposit, rendering the same valid for the duration of the contract.

No Interest will be paid on Security Deposit.

#### Forfeiture of Security Deposit

Security Deposit taken for due performance of the Contract can be forfeited in the event of a breach of contract.

Bank Guarantee obtained towards Security Deposit will be invoked when there is a specific breach on the part of the Contractor.

3.6

#### Warranty :

**Items supplied shall be guaranteed for a period of 24 (Twenty Four) months from the date of commissioning and acceptance of the complete system by TIFR.**

The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

The Supplier further warrants that the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in India.

The defects, if any, during the warranty period are to be rectified free of charge by arranging free replacement wherever necessary.

Supplier will have to provide standby item / substitute of similar specifications at no extra cost, if the defective items will have to be sent back to manufacturer for repairing / replacement. If supplier is not able to provide the standby / substitute equipment, he will have to furnish bank guarantee for the landed cost of the item.

Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. Purchaser shall provide all reasonable opportunity for the Supplier to inspect such defects.

Upon receipt of such notice, the Supplier shall, within a reasonable period of time, expeditiously repair or replace the defective Goods or parts thereof, at no cost to purchaser. Cost, insurance, freight, custom duty, excise duty, other charges if any should be borne by supplier.

If having been notified, the Supplier fails to rectify the defect within **reasonable period of time**, purchaser may proceed to take within a reasonable period such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which purchaser may have against the Supplier under the Contract.

Goods requiring warranty replacements must be replaced on free of cost basis.

3.7 Performance Guarantee / Performance Bond

Performance Bond is obtained as a back-up surety for fulfilment of warranty obligation by the Contractor after satisfactory completion of the contract.

Form of Performance Bank Guarantee

Bank Guarantee as per prescribed format to be executed from any one of the nationalized banks or Scheduled bank on non-judicial stamp paper of appropriate value.

Quantum & Value of Performance Bank Guarantee

Bank Guarantee should be for **Ten Percentage (10%)** of the total value of the purchase / work order including all taxes and duties, Freight and Customs Clearance, Insurance etc.

Validity of Performance Bank Guarantee

Bank Guarantee should be valid till at least two months beyond the expiry date of warranty period.

Performance Guarantee Amount will not carry any interest.

3.8 **INCOME TAX** : Income Tax as applicable will be deducted on the installation and commissioning charges or on charges for supervision of installation and commissioning.

3.9. **GST** : NCRA TIFR Pune being a public funded research institute is eligible for concessional GST as per notification No. 45/2017 dtd. 14.11.2017 in respect of items which goes into our research activities. Necessary certificate will be issued with the purchase order.

3.10 **INDEMNITY BOND**

As per **Annexure -D** to be submitted by the contractor before commencement of the work

3.11 TERMS AND CONDITIONS APPLICABLE FOR SUPPLY OF ITEMS IN RUPPES

- a. All items in full quantity must be delivered in one lot.
- b. Responsibility for safe delivery of all items at destination will be of the supplier and hence they must take all suitable measures including obtaining transit insurance at their cost.
- c. Supplier will have to either provide a substitute / Standby equipment or submit the Bank Guarantee for the landed cost of the items, if it has to be sent back to their premises for repair / replacement during warranty period or post warranty period.

3.12 Duration for Completion of work/Delivery Period

Bidders are requested to specify the **delivery period** in the unpriced bid to be submitted with their technical bid.

3.13 Liquidated Damages

(a) As time is the essence of the contract, Delivery period mentioned in the Order should be strictly adhered to.

(b) If the supplier fails to **Supply** the equipment as per specifications mentioned in the order within the due date, he shall be liable to pay liquidated damages of **0.5 % per week** of value of delayed supply and works for each or part of month, subject to a maximum of **10%** of order value on the unfinished work & items not supplied beyond the due date specified for completion of contract. Such money will be deducted from any amount due or which may become due to the supplier.

3.14 Inspection & Acceptance

The acceptance test will be conducted by purchaser, after the equipment's are received at purchaser's site. The acceptance will involve trouble free operation.

3.15 Test Certificate

Manufacturers Test Certificates in English are to be furnished by the supplier

3.16 Payment :

**70%** payment will be made within ten working days after receipt of items at the destination, **20%** after satisfactory installation, testing and commissioning and balance **10%** payment will be made after deducting agency commission if any against valid bank guarantee for equivalent amount from any Scheduled Bank / Nationalized Bank Valid for Fourteen months from date of dispatch.

3.17 Removal of Rejected Items :

Any item submitted for inspection and rejected by the purchaser must be removed by the supplier, within fourteen days from the date of receipt of intimation of rejection. Such rejected items shall lie at the supplier's risk from the time of such rejection and if not removed within the aforementioned time, the Purchaser shall have the right to dispose off the same at the supplier's risks and on cost and to appropriate such portion of the proceeds as may be necessary to cover any loss or expenses incurred by the purchaser in connection with the said sale.

3.18 Recovery of Sums Due :

Whenever any claim for the payment of, whether liquidated damage or not, arises out of or

under this Contract against the supplier, the Purchaser shall be entitled to recover such sum by appropriating, in part or whole the Security deposit furnished by the supplier. In the event of the Security Deposit being insufficient, then the balance or the total sum recoverable, as the case may be, shall be deduced from any sum then due or which at any time thereafter may become due to the supplier under this or any other contract with purchaser. Should this sum be not sufficient to cover the full amount recoverable the Contractor shall pay to the Purchaser on demand the remaining balance due. Similarly, if the Purchaser has or makes any claim, whether liquidated damages or not against the supplier under any other Contract with the Purchaser, the payment of all amount payable under the Contract by the Contractor including the security deposit shall be withheld till such claims of the Purchaser are finally adjudicated upon and paid by the supplier.

### 3.19 Applicable Law and Jurisdiction of Court

This contract shall be governed by the Law of India being in force. Only the competent Courts of Law in Pune will have the jurisdiction in respect of any dispute, concerning this contract, over the arbitration proceedings etc.

## CHAPTER – 4

### **Technical Specifications for Ductable Packaged AC Unit /** **SCOPE OF WORK**

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## **1.0 GUIDE LINES**

### **1.0 DIVISION OF WORK**

- 1.1 The division of work by the contractor and other agencies shall be as specified under **section: 2 division of work.**

### **2.0 STANDARDS & REGULATIONS**

- 2.1. Each section indicates the Indian Standard Specification to be followed. It is the responsibility of the contractor to meet the statutory regulation local codes and other relevant standards and specifications connected to the work being carried out.

### **3.0 INSPECTIONS & TESTING**

- 3.1 The Consultants/Clients have the right to inspect the plants, equipments and materials at manufacturer's work or at site at any stage and reject the materials that are substandard or do not meet the requirements of the specification and codes.
- 3.2 The contractor shall provide at his cost at site and elsewhere instruments and appliances for testing and equipments and installation at various stages of manufacturing / installation. These instruments shall be got tested & calibrated for their accuracy and performance from the approved institutions.
- 3.3 The inspection and testing carried out by the Consultants/Clients/Third party does not relieve the contractor of their responsibility of carrying out routine inspection during each stage of procurement, manufacture and installation and also meeting the intents and requirements of the specification and statutory requirements.
- 3.4 All equipments and the installation to be tested in the presence of the Consultants/Clients after carrying out necessary rectification, adjustments and balancing. Four sets of test readings should conform to the specification, equipment data, standards and codes.

### **4.0 TRAINING**

- 4.1 The operating staff of the clients shall be trained free of cost for the operation, maintenance overhauling etc. of the equipments and installation.

### **5.0 WORKING DRAWINGS**

- 5.1 Contractor shall prepare five sets of execution drawings and get them approved by the Consultant before carrying out the execution, modify the drawings, if required, to suit the site conditions and get the approval. The execution drawings shall contain all details of finishes, levels and sections.

The approval of the drawings does not relieve the contractor of their responsibility of meeting the intents and requirements of the specification and statutory requirements.

- 5.2 The contractor shall submit the followings details within 10 days of award of the contract.
- (a) List of equipments and the power requirements.
  - (b) Foundation drawings and structural support details for equipment to be provided by the civil contractor.
  - (c) Any other Civil, structural, electrical or plumbing requirement.
  - (d) Bar Chart for proper execution of the work along with Cash flow statement.
  - (e) List of working drawings that the Contractor proposes to make

- 5.3 On completion of the installation, the contractor shall prepare and submit AS EXECUTED drawing incorporating all modification carried out during the execution.

## **2.0 General Conditions of Contract:**

1. Guarantee :  
**Refer Chapter 3 Special Conditions of Contract (SCC).**
2. **PACKING, FORWARDING & STORAGE AT SITE**  
**Refer Chapter 2 General Conditions of Contract (GCC)**
3. Material unloading, shifting and lifting of equipments to the place of installation shall be the scope of supplier. (New package units are to be installed in ground floor A C Plant room for auditorium only in the Multi-purpose building at GMRT)
4. Space for accommodating all the equipments and components involved in the work shall be arranged by the NCRA. Watch and ward to be responsibility of the contractor. Safe custody of all machinery and equipment supplied by the contractor shall be the responsibility of the contractor until final taking over by the TIFR.
5. The Contractor shall provide necessary barriers, warning signals and other safety measures while laying pipelines, cables etc. or wherever necessary to avoid accident. He shall also indemnify TIFR against claims for compensation arising out of negligence in this respect. Contractor shall be liable, in accordance with the India Law and Regulations for any accident occurring due to any cause. The department shall not be responsible for any accident occurred or damage incurred for claims arising there from during the execution of work. The contractor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the contractor due to above provisions thereof.
6. Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall deemed to be included in their tendered cost-whether specifically indicated in the schedule of work or not:-
  - a. Equipments including foundation bolts and vibration isolation spring / pads, foundations will be made by TIFR / GMRT. However bidder should provide the required foundation details / drawings well in advance for its construction.
  - b. Suspenders and / or cable trays for laying the cables.
  - c. Sealing of all floor slab / wall openings provided by the contractor for pipes and cables laying.
  - d. Painting of all exposed metal surfaces of equipments and components with appropriate colour.
  - e. Making good all damages caused to the structure during installation and restoring the same to their original finish.
7. All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended to date. They shall also conform to CPWD General Specifications for Electrical works, Part-I: Internal, 1994 and Part-II: External, 1994, amended to date.
8. Within **fifteen days** from the date of receipt of the letter of acceptance, the successful tenderer shall submit his programme for submission of drawings, supply of equipment, installation, testing, commissioning and handing over of the installation to the Engineer-

in-Charge. This programme shall be framed keeping in view the important function/seminar/conference directly affecting the normal course university operation.

9. All tools and tackles required for unloading / handling of equipments and materials at site, their assembly, erection, testing and commissioning shall be the responsibility of the contractor.
10. All sundry equipments, fittings, assemblies, accessories, hardware items, foundation bolts, supports, termination lugs for electrical connections, cable glands, junction boxes and all other items which are useful and necessary for proper assembly and efficient working of the various equipments and components of the work shall be deemed to have been included in the tender, irrespective of the fact whether such items are specifically mentioned in the tender or not.
11. Refrigerant pipe length, area of duct, size of the damper given in the technical specifications are approximate. It may slightly vary depending upon the site conditions. Payment will be made at actual as per the unit rate given in the suppliers offers.
12. The entire work of manufacture / fabrication, assembly and installation shall conform to sound engineering practice. The entire installation shall be such as to cause minimum transmission of noise and vibration to the building structure.
13. Care shall be taken by the Contractor during execution of the work to avoid damage to the building. He shall be responsible for repairing all such damages and restoring the same to the original finish at his cost. He shall also remove all unwanted and waste materials arising out of new AC systems installation from the site of work from time to time.
14. The power supply for testing and commissioning of the complete installation shall be made available by the TIFR to the contractor. The supply cable and control cables (appropriately ISI marked) to out door units have to be made available by the contractor from indoor units and nothing extra shall be paid on this account.
15. All equipments shall incorporate suitable safety provisions to ensure safety of the operating personnel at all times. The initial and final inspection reports shall bring out explicitly the safety provisions incorporated in each equipment.
16. The Contractor shall guarantee the complete system to maintain the specified conditions under all conditions of ambience and internal loads subject to the condition that designed outside conditions & designed internal loads are not exceeded.
17. The contractor shall ensure adequate and prompt after sales service in the form of maintenance, spares and personnel as and when required and shall minimise the break down period. In case of equipment supplied by other manufacturers, the firm shall furnish a guarantee from the manufacturer for the same before the plant is taken over.
18. A/C units shall be provided with Micro processor controller which operates the A/C unit automatically for maintaining the required inside conditions. Auto-start with necessary time delay after power interruption shall be in built feature of the air-conditioning system.  
EXTERNAL overload relay of suitable range, for all compressors shall be provided in addition to inbuilt Internal thermal protector.

Separate hand operated selector switch, out-side microprocessor controller circuit separately for Manual and Auto mode selection shall be provided. (This facility shall give the free option to run the unit either in Auto mode or in Manual mode at will bypassing the Microprocessor controller)

### **3.0 Important Note for contractors (For A.C. Works)**

**[See the Chapter 1, Chapter 2 and Chapter 3 of this Tender Documents).**

## **4.0 SPECIAL CONDITIONS OF CONTRACT (FOR A/C WORKS)**

### **1.0 I.S.S.: STANDARDS :**

The Air Conditioning equipment and installation shall conform to various standards amended up to date wherever applicable. The list of IS standard is as given in the tender and also appended as Annexure C for information of the tenderers.

### **2.0 DRAWING TO BE SUBMITTED FOR APPROVAL :**

The contractor shall get the following drawings approved before the start of the work:

- a. A dimensional drawing giving complete details of the erection of the equipment in plant room (including condensers, electrical panels and refrigerant piping & details of foundations). While deciding layout, future expansion, if any, has to be taken in to consideration.
- b. Electric wiring diagrams for all Electrical equipment including controls showing cable sizes and equipment capacities.

### **3. 0 CO-ORDINATION**

Wherever air conditioning work is being carried out by more than one agency, it should be the aim of different agencies that on their account the work of other agency/agencies is not delayed. Full cooperation and full coordination is to be extended during progress of work and at the time of testing by all the agencies.

## **4.0 COMPLETION DRAWINGS**

The contractor on completion of the work shall submit three sets of following drawings.

- a. Plant installation drawing giving complete details of the entire equipment including foundations.
- b. Three sets of service manuals of air conditioning plant including salient features of the plant.

## **5.0 COMPLETION OF WORK**

The work shall be deemed to have been completed after the fulfillment of the following:

- a. (a) Physical completion of installation of A.C. system including balancing of conditioned air and water circuits (wherever applicable) and successful trial run of the A.C. system by the contractor for a period of 7 days subject to a minimum of 120 hours of running during that period in the presence of representative of Engineer.
- b. Successful completion of final performance cum capacity test as per the departmental standards in the presence of representatives of Engineer-in -Charge and user.

## **6.0: TESTING**

- a. Routine tests certificate for package unit as per IS 8148 shall be furnished along with supply of equipment.
- b. Department reserves the right to depute representative for inspection of material/ equipment and witness the test at contractor's/supplier's works and the firm shall be required to perform routine/type test for each unit. At least one-week notice shall be given by the contractor to the department for coming up for inspection and factory test.
- c. For micro-vee filters and motors etc., only routine test certificate from manufacturers shall be furnished
- d. The contractor shall operate, test and adjust all air conditioning system units, fans, motors, all air handling appliances provided in connection with this installation and shall make all necessary adjustments of air regulating dampers for the purpose of equalization of the flow of air to each and every outlet and inlet.
- e. The contractor, for approval of engineer-in-Charge, shall furnish a carefully recorded detailed record of the results of these adjustments.
- f. Following tests at site shall be conducted after completion of the plant:

### **(i) TRIAL RUN**

After installation is complete physically and all adjustments as listed above are carried out, the plant shall be subjected to trial run. The trial run is to be conducted for a period of 7 days subject to minimum running of 120 hours in the presence of representative of the Department. During this test performance, all the equipment and control system shall be checked. Inside conditions shall also be recorded in this trial run. A record of this test shall be submitted to the Engineer-in-Charge who shall arrange for capacity testing thereafter.

**Proforma For Test Results May Be As Given Below**

S.No.	Items		Test Results
1.	Ambient conditions D.B. Temp.		----- degC
	W.B. Temp.		----- degC
	R.H.		----- %
2.	Compressor's	R.P.M.	-----
	Refrigerant gas Suction pressure		-----kgs/sq.cm
	Refrigerant gas Discharge pressure		----- kgs/sq.cm
3.	Compressor Motors	R.P.M.	-----
	Voltage		-----volts
	Current		-----Amps.
4.	Condensers	Air flow rate	-----CFM
		Air temp.	
		Entering	----- deg C
		Leaving	----- deg C
5.	Cooling coil	Total air quantity	
		across coil	-----C.M.H.
		Coil face area	----- Sq.m.
		Air temperature	
		entering (D.B.)	----- deg C
		entering (W.B.)	----- deg C
		leaving (D.B.)	----- deg C
6.	Fresh Air	Intake Face area	----- Sq. m.
		Air quantity	----- C.M.H.
7.	Room condition at the working		Temperature
	place (Number of readings should		D.B. ----- deg C
	be taken and average taken out)		W.B. ----- deg C
8	Controls	Function of each control should be tested and report furnished	
		Good	better
			best

**(ii) INITIAL ACCEPTANCE TESTING**

After completion of trial run, the plant shall be subjected to initial acceptance testing as per standards of the department. This testing shall be conducted jointly by the representative of the Engineer-in-Charge and user. A list of all defects and discrepancies shall be prepared during the test.

**(iii) FINAL PERFORMANCE CUM CAPACITY TEST**

This test shall be conducted jointly by the representative of the Engineer-in-Charge and user as per standards of the department. Necessary record of the supply voltage, currents drawn by the machines, standing and running pressure of low / high side, protections and set points in microprocessor based controller etc may jointly be made.

**(iv)** The Department shall have the right to operate all equipment in operating Condition whether or not such equipment has been accepted as complete and satisfactory. Repairs and alteration shall be made at such time as directed by the Engineer-in-charge.

**(v)** In special circumstances, the department may have to use the plant to air Condition some areas even before the completion of whole work. The firm shall cooperate fully under such circumstances

g. Wherever relaxation are required, these should be obtained from Dean TIFR well before the final performance-cum-capacity test. All test equipment, the operating personnel, oil and refrigerant required for testing shall be supplied by the contractor.

**8.0 OPERATION**

The contractor will provide staff for operation for 120 Hrs Trial run. No extra payment for this operation will be reimbursed to the firm by the Department. Staff will work under the supervision of the departmental officers for proper operation.

**9. MAINTENANCE**

The contractor shall provide free maintenance for a period of 12 months after completion of final performance cum capacity test by the department and attend to any defects that may arise in operation of the plant during this period.

**10. TRAINING OF DEPARTMENTAL PERSONNEL**

The contractor shall arrange to impart the training to the departmental personnel on the following aspects prior to provisional takeover of the plant :-

- (a) Operation of Plant.
- (b) Adjustments of settings for microprocessor controls and protection devices.
- (c) Preventive maintenance.

## **5.0 SYSTEM DESIGN & DIVISION OF WORK**

### **1.0 SCOPE**

1.1 The scope under this section shall cover the system design and the scope of the work.

- 1.2 The scope of work shall cover the following
- a) Air Cooled DX System (Ductable & Hiwall Split AC Units)
  - b) Air Handling Units
  - c) Condensing units
  - d) Refrigerant Piping and Controls
  - e) Fresh Air Distribution System
  - f) Insulation
  - g) Electrical works & cabling

1.3 HVAC Vendors Scope:

- a. Supply, lifting, shifting, installation, testing and commissioning of Air Handling units, Ductable / Hiwall Split AC Units, condensing units. Necessary refrigerant piping, drain piping, refrigerant gas, oil is in HVAC Vendors Scope.
- b. Supply, Installation, Testing & Commissioning of low side HVAC System (i.e. Ducting, Insulation, Fresh Air System, Grills, Diffusers etc) is in HVAC Vendors scope.
- c. Propeller, Inline type exhaust fans are proposed for Ventilation of Toilet, Pantry, preparation areas, this part is covered as part of HVAC Vendors scope.

### **2.0 BUILDING**

**Proposed Multipurpose Building at GMRT, Khodad, Pune** has planned for its Auditorium and Lab areas.

### **3.0 HVAC REQUIREMENTS**

3.1 The HVAC requirement proposed are as under.

- a) Air Conditioning – Auditorium.
- b) Ventilation & Exhaust – As per site requirement.

3.2 Being auditorium in multipurpose area is normally operating during 9.00 hrs. to 21.00 hrs; 24 x 7 operation is not considered.

3.3 Above areas should be maintained at Negative pressure conditions.

### **4.0 DESIGN CONDITION**

4.1 The outdoor design condition are based on the weather data and design conditions are as shown below:

Site	:	Pune
Latitude	:	18.3 deg North
Altitude	:	559 m above M.S.L
Daily range	:	31 °C



Design Weather data:		
<u>SEASON</u>	<u>DB (°C)</u>	<u>WB (°C)</u>
a) Summer	40	24.4
b) Monsoon	28.3	26.1

Winter conditions are not being considered for design purpose.

4.2 The indoor design condition proposed, under considered load, are as shown below:

Auditorium :  $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Relative Humidity: For all areas - Not exceeding 60%\* (Comfort Zone)

Monsoon Reheat is not considered hence humidity may increase upto 65~70% during peak monsoon. Cooling coil to be selected accordingly.

4.3 Automatic control for the temperature shall be provided. However there shall be no humidity control and hence the RH during monsoon may go up.

## 5.0 INTERNAL LOADS & COOLING LOAD

5.1 The internal loads for various areas are as shown below:

- FRESH AIR: For Auditorium: as specified in ASHRAE-62.1-2010.
- VENTILATION & EXHAUST: Toilet Ventilation (Exhaust) system is considered based on 12 Air Changes / hour.
- AREA TO BE AIRCONDITIONED: Auditorium.
- Floor above / below :
  - Auditorium - Exposed with Underdeck Insulation / NA

### EQUIPMENT LOAD & LIGHTING LOADS:

The other Equipment and Lighting loads are considered as per heat load summary: Annexure I

## 6.0 ROOM COOLING LOAD & AIR COOLED DX SPLIT AC UNIT CONFIGURATION:

ROOM COOLING LOAD: As per heat load Summary Sheet: Annexure I.

Working + Stand-by System requirements are mentioned in Annexure-I

## 7.0 CONTROLS

7.1 All Indoor Units (IDUs) shall have automatic DB temperature control. No Humidity Control is envisaged.

7.2 All existing equipments are considered with normal operations.

## 8.0 DIVISION OF WORK

8.1 The division of work between the air-conditioning contractor and others shall be as mentioned below:

A. HVAC Vendors Scope:

- a. Supply, lifting, shifting, installation, testing and commissioning of Air Handling Units, Ductable Split AC Units. Necessary refrigerant piping, drain piping, refrigerant gas, oil is in HVAC Vendors Scope.
- b. Supply, Installation, Testing & Commissioning of low side HVAC System (i.e. Ducting, Insulation, Fresh Air System, Grills, Diffusers etc) is in HVAC Vendors scope.
- c. Propeller, Inline type exhaust fans are proposed for Ventilation of Toilet, Pantry, preparation areas, this part is covered as part of HVAC Vendors scope.

B. The following works shall be carried out by other agencies in coordination with and under direct supervision of HVAC agency:

a. Electrical Works:

1. Provision & Termination of main power supply and earthing to all Panels / Equipments.
2. Switch and socket outlet within one-meter distance of Cassette units.
3. Hook-up of fire and smoke dampers in ducts and AHU motors to zonal + main fire panels.

b. Plumbing Works:

- Drain piping termination at respective nearest drain point through floor drain points with 'P' traps. – Not applicable for Ventilation & Exhaust Units upto drainage chamber provided by base builder.

c. Civil Works, False Ceiling & Carpentry:

- ❖ Making of boxing and false ceiling works.
- ❖ Any civil, masonry and breaking up and making of holes in the existing structure.
- ❖ Wall openings and making up of the same as required for HVAC purpose.
- ❖ False ceiling works, cut-outs in false ceiling for grills and diffusers
- ❖ Foundations
- ❖ Insulated boxing

All above exclusions are applicable only if they are informed in writing and after obtaining written instructions from the Consultant / Architect / Client within 10 days of issue of work order / LOI, failing which this shall be deemed to have been included by the Precision AC contractor.

## **6.0 REFERENCE DRAWING**

### **1.0 SCOPE**

- 1.1 The scope under this section covers the basic drawings and details to understand the following:
- a) Scope of work
  - b) Location of equipments
  - c) General idea on the entire installation
  - d) Material requirements and specification requirements for the completion of work in the stipulated time schedule.
- 1.2 The reference drawings are schematic to give idea a general requirement prepared on the basis of preliminary requirements and data available. They are subject to undergo changes and modifications subject to the finalisation of details and requirements of the clients.
- 1.3 The detailed working drawings and the drawings required for the submission to statutory authorities shall be the responsibility of the contractor. Contractor shall submit minimum five copies of the following drawings to the Consultants for their scrutiny / approval before issuing to the statutory authorities and site for execution.

Numbering of Shop Drawings:

SR. NO.	DRAWING NO.	TITLE
1.	GMRT-03-014-AC-01-00	MPB Ground floor HVAC layout
2.	GMRT-03-014-AC-02-00	MPB FF HVAC layout for <b>Auditorium</b>
3.	GMRT-03-014-Ac-03-00	HVAC Section for Auditorium

**Note: Above mentioned drawing indicates layout of HVAC for auditorium. Bidders should refer and consider for quotations.**

**Bidder to visit actual site for ducting, cabling quantity requirement before bidding.**

Any additional Shop Drawings required for the proper execution of the project shall be properly numbered and submitted.

## **7.0**      **MAKES OF MATERIAL**

### **1.0**      **SCOPE**

**1.1**      The scope of this section covers the recommended makes of equipments, material components. The final choice of makes shall be indicated at the time of finalisation of the order.

**1.2**      Items for which makes are not recommended, contractor shall obtain approval from Consultant prior to procurement.

### **2.0**      **MAKES RECOMMENDED**

**2.1**      The makes of material recommended are as shown below. The offers shall be strictly on the basis of the makes underlined.

<b>ITEM</b>	<b>APPROVED MAKES</b>
<u>Refrigeration Machines:</u>	
Air-cooled Split AC Units	Voltas, Bluestar, Daikin, LG
Condensing Units	Voltas, Bluestar, Daikin, LG
Air handling units	Air Vision, Zeco, Nutech, Edgetech
<u>Air Distribution:</u>	
GS sheets - LFQ as per IS 277	Jindal, SAIL-Bhilai
Insulated flexible ducts	Caryaire,
VCD, Back draft Dampers	Caryaire, George-Rao, Dynacraft
Pre Fabricated ducting	Nutech, Zeco
Fire and Smoke Dampers	Caryaire, George-Rao, Dynacraft
Al. Louvers	George-Rao, Caryaire
Aluminium Box Type Dampers	Air Products, Dynacraft
Grills, Diffusers, Disc Valves	Air Products, Dynacraft
Damper Actuator Motors	Belimo, Siemens
Air Filters	Dyna filters, Ucco-Mech, Airtech
MS Epoxy Coated Grills - Fire Rated	George-Rao, Dynacraft
Air Volume Regulator	Aldes-Euro register, Trox

ITEM	APPROVED MAKES
<u>Refrigerant Piping:</u>	
Copper pipes & Fittings	Nippon, Bundy
<u>Insulation:</u>	
Glasswool (Fibre Glass)	UP Twiga, Kimmco, Owens-Corning
Nitrile Foam, EPDM (Closed Cell)	Aeroflex, K-Flex, Armacell, Superlon
Tarfelt/ CPRX Compound	Shalimar, Shalicoat
<u>Miscellaneous:</u>	
Vibration Isolators/Cushy Foot Mounts	Dunlop, Resistoflex
V-Belts	Dunlop, Fenner
Hardware	Sundaram Fasteners, GKW, Fittight
Anchor Fasteners	Shakti, Hilti
Paint	Nerolac, ICI, Asian, Berger
Welding Rods	ESAB, Advani-Orlecon
<u>MV Switchgear and Ancillaries:</u>	
MCCB	ABB, Schneider, Legrand
MCB/DB/RCCB	ABB, Schneider, Legrand
HRC and Control Fuses	Siemens, L&T
Starters and Contactors	Schneider, Siemens, L&T
Relays	Schneider, Siemens, L&T, MDS
Timer	L&T, MDS, Legrand
Indicating Meters	IMP, Mecco, L&T, AE, Enercon
Signal Lamps	Teknic, Siemens
Push Buttons	Siemens, Teknic
Cables	Polycab, RR, Finolex
Glands	Commet, Braco
Lugs	Jainson, Dowel
Wires	Finolex, Polycab, RR

## **8.0 MEASUREMENTS & PAYMENTS**

### **1.0 SCOPE**

- 1.1 The scope under this section covers the mode of measurements and payments for HVAC System.
- 1.2 The general requirements, break-up and mode of payment etc. shall be as specified under MEASUREMENTS AND PAYMENTS:

### **2.0 MEASUREMENTS**

<b>Sr No</b>	<b>Item</b>	<b>Item Included</b>	<b>Item Excluded</b>
1.0	<u>EQUIPMENTS</u>		
1.1	<u>GENERAL</u>		
	Each equipment shall be measured as one unit and classified based on the type and capacity of equipment.	Complete unit with all components and accessories required for the specific duty	
1.2	<u>REFRIGERATION UNITS</u>		
	Each ODU / IDU shall be measured as one unit and classified based on the capacity.	Fan, filter, cooling coil, drain pan, motor & drive assembly, thermal insulation, baseframe, outlet flexible connection, vibration isolators, access doors etc.	Nil
2.0	<u>REF. PIPES</u>		
	The pipes shall be measured on the basis of unit length (meter) and shall be classified based on the material and diameter.	Pipes with all fittings and accessories like couplings, tees, bends, reducers, nipples, flanges, plugs, bushes etc. supports and hangers	Nil
3.0	<u>AIR DISTRIBUTION</u>		
3.1	<u>DUCTS</u>		
	The ducts shall be measured on the basis of sq.m of surface area of the fabricated duct and shall be classified on the basis of the thickness of GI sheet.	GI sheet, fabrication stiffeners, flange connection, guide vanes, splitters, opening for mounting collars, grills and diffusers, supports and hangers	Nil
3.2	<u>GRILLES &amp; DIFFUSERS</u>		
	The grilles and diffusers shall be measured on the basis of face area in sq.m	Grilles and diffusers with flange, collar, damper for supply grilles & damper of neck size for diffusers.	Wooden / Al. frames to be included.

<b>Sr No</b>	<b>Item</b>	<b>Item Included</b>	<b>Item Excluded</b>
4.0	<u>THERMAL &amp; ACOUSTIC INSULATION</u>		
4.1	<u>FOR DUCTS</u>		
	The ducts insulation shall be measured on the basis of unit surface area (sq. m) of the bare duct and classified based on thickness of insulation.	<b>Insulation, bonding cladding and fixing material</b>	Nil
4.2	<u>WALL, FLOORS &amp; CEILING</u>		
	The wall, floors & ceiling acoustic insulation shall be measured on the basis of the surface area in sq.m of the surface insulated and shall be classified on the basis of thickness of insulation	<b>Insulation, bonding cladding and fixing materials and wooden frame work</b>	Nil
5.0	<u>ELECTRICAL WORK</u>		
5.1	<u>POWER PANELS</u>		
	Each power panel shall be measured as one unit	<b>Incoming &amp; outgoing feeders, busbars indicating and control instruments, internal wiring etc</b>	Nil
5.2	<u>CONTROL PANELS</u>		
	The control panels along with the cabling shall form part of the equipment & hence no extra payment shall be made	<b>Control panel with instruments and indicators, piping and cabling</b>	Remote start stop push button and connected cabling
5.3	<u>POWER CABLING</u>		
	The power cabling shall be measured on the basis of unit length of cable between the lugs at each end termination	<b>Cables, clamps termination</b>	End
5.4	<u>CABLE END TERMINATION</u>		
	Each cable end termination shall be measured as one unit	<b>Glands, lugs</b>	Nil
6.0	<u>MISCELLANEOUS</u>		
	The structural supports, hangers etc. shall form part of the item supported and hence no additional payments applicable	Structural supports, grouting, red-oxide, primer, final painting	Nil

### 3 MEASUREMENT FOR PAYMENT:

- 3.1 For insulated piping and drain piping, the measurements shall be based on per running metre basis and shall include insulation for various fittings such as flanges, elbows etc. No extra quantities shall be allowed for such fittings etc. However, each valve shall be counted as 1 meter of insulated pipe of the same diameter for the purpose of measurement. For insulation of ducting the measurements shall be based on bare ducting surfaces and this shall be inclusive of insulation on flanges, elbows, supporting angles etc. For acoustic lining the insulation measurements shall also be based on bare duct areas. For insulation on walls and exposed ceiling etc the measurements shall be taken on bare wall / ceiling floor surfaces. For beams and columns measurement shall be taken on finished surfaces, after insulation.
- 3.5 For grilles/diffusers etc. the measurements shall be based on the neck area of the unit.

Ducting shall be measured for the actual finished surface as per the surface developed. No allowance for cut outs, openings less than 1.6 sq. m. shall be considered. However, reduction in Insulation & ducting measurements for cut outs larger than 1.6 sqm shall be applied.



**OUTDOOR UNITS (CONDENSING UNITS):**

The outdoor unit shall comprise of following facilities:

- ❖ Condenser fan(s)
- ❖ Constant speed scroll compressor
- ❖ Air cooled Condenser coil
- ❖ Resin based grille

The outdoor unit shall be suitable for a power supply of 415V / 3 phase / 50Hz. The outdoor unit shall have a start current and run current as per detailed electrical characteristics recommended by the manufacturer.

The outdoor unit shall be complete with expansion valves, oil separators, crankcase heaters, suction and liquid shut off valves, strainers, liquid receivers and accumulators as per requirements. The compressor pack shall be mounted on a sliding tray with springs and shock absorbing rubbers to facilitate service and maintenance.

The Compressor shall be reputed make high EER, high efficiency compliant *SCROLL* design. (For outdoor units upto 3TR (Hi-wall Split Units) the machines shall be with reciprocating/ rotary compressors). Each compressor shall have rotolock valve for service purpose and with in-built overloads, HP and LP Controllers. The compressor shall be mounted on vibration isolators/rubber grommets. Pressure gauge ports shall be provided in each compressor at appropriate location to measure suction and discharge and related pressures. Compressors should be located in such a way that removal of one compressor should not affect the operation of the other circuit.

The casing of the compressor shall be hermetically sealed scroll and of a standard make, suitable for operation on R-407 / R-134a refrigerant. The compressors shall be suitably protected by dual pressure-stat, motor winding thermostat and special electronic device to safeguard against single phasing and overloading. A system to reduce energy consumption, by way of Condenser recycling, Compressor hunting etc. during part load periods shall be preferred.

The outdoor unit shall be complete with all safety devices including high pressure switch, fuse, thermal protectors for compressor and fan motors, under voltage / over-voltage / single phasing protector, over current protectors for compressor motors, sequential start and recycling timers, and a common fault indication. The compressors, refrigerant circuits and electrical box should be placed in and enclosed compressor compartment separated from the air passages.

The unit shall be sturdy, elegant in appearance and shall be quiet and vibration free in operation. The sheet metal shall be min. 16 G in construction. The outdoor unit shall be completely weatherproofed and be factory assembled, pre wired and complete with all necessary electronic and refrigerant controls for easy installation. The unit shall be selected to enable it to run at low noise level of 60 Db (A)

The outdoor unit shall be factory charged with the necessary CFC free refrigerant-R407 / R-134a. Additional refrigerant charge shall be added, as per the site conditions and as per recommended by the manufacturer, during the commissioning procedure.

The outdoor unit heat exchanger shall be 'rectangular' shaped and shall be formed of seamless copper tube with internal grooving, and mechanically bonded to aluminium fins.

The outdoor unit dimensions shall be optimised to assist with the movement of the equipment to the agreed outdoor unit location as well as ensuring that the area of steel decking is kept to a minimum.

The outdoor unit heat exchanger shall be full height at the rear of the unit and shall be formed of seamless copper tube with internal grooving, and mechanically bonded to aluminum fins.

The outdoor unit fan motor(s) shall be totally enclosed and incorporate a thermal fuse. The packaged air conditioner shall have a control panel for automatic / manual sequential operation of the components and safety control.

The Unit shall have its' own suitable Isolator device (MCB/MCCB etc as required) for electrically isolating the Machine during emergency or maintenance.

The outdoor fan(s) shall be of the direct drive sickle shape and of plastic construction. Air discharge shall be angled to ensure that the fan will not stall if overcome by the weight of dust or other debris. The air outlets shall have plastic coated wire fan guards.

The outdoor fans shall accommodate a short amount of ductwork, where required, in order to expel discharge air when units are sited internally. Where a discharge air duct is used, removable ducting is recommended to ensure access to the fan section. The fan static should be able to take care of the losses due to duct cowl.

The unit casing shall be manufactured from polyester powder coated galvanised sheet steel. The colour finish shall be to the manufacturers' recommendations.

Access to the units for routine service and maintenance shall be through the front panel only. For installation purposes only, access to the units shall be via removable panels.

Units shall be installed making provision for the minimum space requirements between adjacent units or obstructions, as specified and as offered in the manufacturers data

Interconnecting pipe work from indoor units shall be made onto the outdoor unit terminations using brazed connections, in accordance with manufacturer's stated requirements.

Necessary MS stands duly powder coated shall be used to mount the Condensing Units.

Electrical System: A main isolation (MCB) should be provided on the unit sized to meet the system total power requirement.

Within the panel individual power loads should be distributed equally across the phases through a bus bar.

Low voltage and high voltage protection for microprocessor control.

All individual wires should be of copper and colour-coded or should be numbered at their point of termination to facilitate servicing.

Low voltage control wiring and power wiring should be segregated from each other. The Electrical power system should conform to relevant I.S. / I.E. standard. The following should be incorporated:

Motor Protection circuit breakers (MPCB) of suitable rating should be provided for each sub-circuit, Contactors for automatic Micro Processor Control. Single-phase / phasing preventers in the main incoming and Auto-Off-Manual switch is to be provided.

## INDOOR UNITS:

The following models of indoor units shall only be acceptable:

- ❖ Ducted Horizontal
- ❖ Hi-Wall Mounted type
- ❖ Cassette type

The indoor unit shall be constructed from galvanised sheet metal panels. All surfaces shall be thermally and acoustically insulated.

The indoor unit shall include fan impeller with direct drive fan motor. The motor shall be sealed and lubricated for life, the whole assembly being statically and dynamically balanced. The motor shall be of the totally enclosed, permanent split capacitor type with thermal safety cut out.

The Indoor Unit has been designed to suit low noise application. i.e. the selected fan should not have an outlet velocity exceeding 9 m/s and a noise level of less than 60 dBA at 1 m from the IDU.

The evaporator coil shall be of 15 mm O.D. copper tube with 5 aluminium fins per cm and shall be complete with thermostatic expansion valve and a distributor. Preferably a 4-rows deep coil should be provided.

Evaporator coils should be four in number one for each refrigerant circuit and each coil should be rated for 5.5 TR rating of ductable package unit. It shall have good mechanical bond for maximum heat transfer with adequate fin thickness & with hydrophilic coating.

The fan shall be double inlet type with curved multi blade impeller to develop a min. of 40-mm static pressure external to the Unit that shall be adequate to overcome the pressure loss in the duct and return air of the installation.

The indoor unit heat exchanger shall be manufactured from seamless copper tubes with internal grooving, and mechanically bonded to aluminium fins. All tubes shall be brazed into copper headers and return bends and fully tested at works.

There should be four self-contained independent refrigerant circuits in the package air conditioner having totally independent piping hook up for each combination of compressor-evaporator and air-cooled condenser constituting one refrigerant circuit. The refrigerant pipe terminations shall be fitted with flared connections, complete with flare nuts.

The indoor unit shall incorporate a one-piece insulated drain tray. The drain connection shall be of a suitable size and be connected to either the gravity condensate system or a suitable condensate pump, supplied by the specialist installer.

The indoor unit shall be complete with all necessary controls including thermostatic expansion valves etc. The indoor unit shall be provided with its own integral temperature sensor fixed onto or adjacent to the return air grill, measuring the return air temperature.

The indoor unit shall be suitable for a power supply of 240V/ 1 phase/ 50Hz and OR 415V  $\pm 10\%$  / 3 phase/ 50Hz as per the size selected & shall withstand supply voltage variations as per respective ISS. Automatic three min time delay should be provided to start / restart the compressors. Bidders should submit along-with their offer the technical design details of the entire ductable package AC system.

The indoor unit shall incorporate a return air filter. Filters shall be removable via the front, or underside of the unit, without removing any screwed panels. Filters shall be of the washable type unless otherwise specified.

## **10.0 AIR HANDLING EQUIPMENTS**

### **1.0 SCOPE**

The scope under this section shall cover supply installation, testing and commissioning of Air Handling Equipment consisting of:

- a) Supply, Lifting, Shifting, Assembly, Installation, Testing & Commissioning of Air Handling units

### **2.0 STANDARDS**

2.1 The following standards shall be applicable

- a. IS : 4283 Hot air fans
- b. IS : 8272 Industrial cooling fans (man collers)
- c. IS : 4894 Centrifugal fans
- d. IS : 10470 Air cooled heat exchangers
- e. IS : 2997 Air circulator type electrical fan and regulator
- f. IS : 1169 Electrical pedestal type fans and regulators
- g. IS : 374 Electrical ceiling type fan and regulator

### **3.0 GENERAL REQUIREMENTS**

- 3.1 The air handling equipments shall meet the requirements indicated in the Equipment Data and shall be complete with fan, casing, motor mounting frame, vibration isolators.
- 3.2 The ventilation units, AHU's U's shall be provided with air filters. Equipments used for heating/cooling system shall be provided with air-cooled heat exchangers.
- 3.2 The equipment data indicated is a guideline for selection of the equipment based on various parameters, which may vary from manufacturer to manufacturer. Hence the contractors should verify the adequacy of the equipment offered considering the basic requirement and parameters indicated in the equipment data. The vendor should also verify the adequacy of space requirements as given in the Machine Configuration sheet and space location layout.
- 3.4 All fans shall be double ball or roller bearings and selected for low noise level.
- 3.5 All air handling equipment shall be connected to the fire alarm system and shall be automatically switched off incase of fire in the zone served by that equipment. The supply and return air intakes shall be provided with fire dampers.

#### 4.0 AIR HANDLING UNITS

- 4.1 The air handling units shall be of draw through sectionalised construction comprising of:
- Filter section
  - Fan section
  - Heat Exchanger section
  - Return air Plenum
- 4.2 Each section shall be constructed out of 22 SWG preplasticised GI (outer skin) and 24 SWG GI (inner skin) sheet steel with spray galvanised MS frame work or extruded aluminum re-inforcement members. The sections shall be bolted together and shall be easily detachable for easy maintenance and repairs.
- 4.3 The filter section, fan section and the heat exchanger section shall be as specified in the respective heading in this section.
- 4.4 The air-handling units shall be provided with thermal and acoustic insulation as specified in the respective sections. The insulation shall be minimum 25 mm thick PUF of at least  $40 \pm 2$  kg/m<sup>3</sup> density. The inside outside skins shall be minimum 0.8-mm and 0.63-mm thick GI or pre-plasticised sheet steel. Vendor to consider Thermal break.

#### 5.0 FAN SECTION

- 5.1 The fan sections shall be sectionalised construction and consisting of casing, fan, motor, belt drive etc. The casing shall be fabricated out of GI sheets of minimum 1.2 mm thick welded construction with 2mm thick MS angle frame work and cross brazing.
- 5.2 The fans shall be backward curved centrifugal double inlet mounted on a common shaft. The fans shall be of GI, house in streamlined scroll cases and statically and dynamically balanced. The fans sections shall be provided with detachable filter section and damper section. The fans shall be Kruger make.
- 5.3 The drive assembly shall consist of motor; multi grooved adjustable pitch pulleys and multiple flat belts. The motor mounted on adjustable base frame shall be erected over the fan section through mounting shoes or structural members. The belts shall rotate in self-aligning ball bearings.
- 5.4 The fan section have proper access door with marine light with an interlocked door limit switch (one working and one standby) shall have the shaft extended on both sides with drive pulleys.

#### 6.0 CENTRIFUGAL FANS

- 6.1 The centrifugal fans shall be heavy duty single or double suction conforming to IS: 4894. The casing shall be of heavy gauge steel sheet/plate seam welded with necessary stiffened with angle or channel side bracings and with fixed suction & discharge flanges, manually operated suction vanes, access doors etc.
- 6.2 The impellers shall be backward curved hollow heavy section aerofoil construction with internal re-inforcement with non-overloading characteristic. The wheels hubs shall be machine cast or fabricated.
- 6.3 The shafts shall be of hot rolled steel or alloy steel liberally sized to achieve the critical speed at least 30% above the normal speed. The bearing shall be heavy-duty self-aligning regressive ball or roller type capable of absorbing radial and thrust loads.

## 7.0 FILTERS

7.1 The filters shall be metallic, PVC or fabric as specified in equipment data.

7.2 Metallic filter shall consist of V fold galvanised wire mesh inter speed with a flat layer of galvanised wire mesh. The density of the filter medium shall increase in the direction of air flow. Wire mesh edges shall be suitable hemmed to eliminate the danger of abrasion during handling. Filter medium shall be supported on either side by galvanised expanded metal casing. Filter frame shall be constructed of galvanised sheet of thickness not less than 18 gauge. Filter shall be either dry / oil melted type. Oil shall be suitable mineral oil of approved type.

Alternatively the filter frames shall be fabricated for aluminium alloy conforming to IS: 737 and medium shall be aluminium alloy.

All filters must be capable of being completely cleaned of their accumulated dust by flushing with tap water.

7.3 Fabric filters shall be flat filter fabric or suitable material recommended by the manufacturer stitched by galvanised wire gauge support and crimped to form deep folds. Suitable aluminium spacers shall be provided to ensure uniform distribution of airflow through the filter. Filter casing shall be provided with neoprene sponge rubber sealing, the filter shall be either dry type or oil wetted type, with element of three ply or five ply construction as specified in data sheet.

7.4 Nylon filters shall be made of nylon fabric with continuous water spraying on it from a header for keeping it clean. Efficiency of this filter should be 85% down to 10 microns.

## 8.0 HEAT EXCHANGERS

8.1 The heat exchangers/cooling coils for the air handling equipment shall be air cooled with meeting the requirements shown in the equipment data. The face area is based on the proper bonding of the tubes and fins and efficiency of heat transfer. Hence coil area indicated is only a guideline and while selecting and offering the coils the contractor should ensure the coil leaving conditions and the room conditions for the specified cooling load.

8.2 The coil section for AHU shall consist of single coil for cooling and heating or two separate coils for cooling and heating as specified. The coils shall consist of staggered copper coils with bonded aluminium fins. There shall be minimum 500 fins per meter evenly spaced by means of integral collars. The face area shall be sufficient to meet the cooling load at the same not less than the area indicated in the equipment data and the air velocity across the coil is not exceeding 2.5 meter per second.

8.3 The number of rows of coils for cooling coils shall be **SIX (6)** as indicated on the equipment data. The coils shall be tested to 20 Kg/sq.cm air pressure.

8.4 The coil connection shall be on one side and shall have the following.

- a) Coil configuration as per Configuration of Condensing units.
- b) Thermostatic Expansion Valve with header distribution plate
- c) Strainer
- d) Hand shut off valves
- e) suitable charging valves, liquid line drier/filter with valves, suction/discharge valves for compressor isolation etc as per requirement.

- 8.5 The coil section shall be insulated and shall be with drain tray and insulated drainpipe to the nearest floor drain. The drain pan shall be S.S.
- 8.6 The air-handling units shall be of draw through sectionalised construction comprising of:
- a) Return Air plenum
  - b) Filter section
  - c) Coil section
  - d) Fan section

Each section shall be constructed out of an outer sheet of 22 SWG GI sheet steel and inner sheet of 24 SWG GI sheet steel with extruded aluminium rigid framework & reinforcement members. The sections shall be bolted together and shall be easily detachable for easy maintenance and repairs. The filter section, fan section shall be as specified in the respective heading in this section.

The double skin AHU shall have **43 mm + 2 mm thick PUF** of minimum **40 kg/m<sup>3</sup> density** injected into the inner and the outer skins. The inner skin shall be minimum **0.8 mm thick GI sheet and the outer skins shall be 0.63 mm thick GI sheets.**

#### 8.6.1 Filter Section of AHU

The filters shall be metallic, PVC, fabric or specified in equipment data. Air handling units for shall be provided with Primary and Secondary filtration.

Metallic filter shall consist of V fold galvanised wire mesh inter speed with a flat layer of galvanised wire mesh. The density of the filter medium shall increase in the direction of airflow. Wire mesh edges shall be suitable hemmed to eliminate the danger of abrasion during handling. Filter medium shall be supported on either side by galvanised expanded metal casing. Filter frame shall be constructed of galvanised sheet of thickness not less than 18 gauge. Filter shall be either dry / oil melted type. Oil shall be suitable mineral oil of approved type.

Alternatively the filter frames shall be fabricated for aluminium alloy conforming to IS: 737 and medium shall be aluminium alloy.

All filters must be capable of being completely cleaned of their accumulated dust by flushing with tap water.

Fabric filters shall be flat filter fabric or suitable material recommended by the manufacturer stitched by galvanised wire gauge support and crimped to form deep folds. Suitable aluminium spacers shall be provided to ensure uniform distribution of airflow through the filter. Filter casing shall be provided with neoprene sponge rubber sealing, the filter shall be either dry type or oil wetted type, with element of three ply or five ply construction as specified in data sheet.

The primary filters shall be rated for 50 micron particulate size at 90% efficiency & the Secondary filters shall be rated for 10 micron particulate size at 95% efficiency.

#### 8.6.2 Fan Section of AHU

The fan sections shall be sectionalised construction and consisting of the fan and motor assembly mounted on a common base frame. **This base frame should be independently isolated from the AHU base with spring isolators.** The fan section shall have an interlocked airtight door with a limit switch. The motor shall be interlocked with this limit switch so that the same should not start when the door is open.

The drive assembly shall consist of motor, multi grooved **taper lock pulleys and multiple flat belts.** The motor mounted on adjustable base frame shall be erected on

the common base in the fan section. The rotors shall rotate in self-aligning ball bearings. The drawing / sample of the entire unit shall be got approved by the Consultant before manufacturer.

**Acoustic Insulation of Fan Section :** Closed Cell Elastomeric Foam in roll / sheet form of minimum density 40 kg/m<sup>3</sup>, thermal conductivity-0.037 W/m deg. K, Confirming to Class 'O' fire category, Thickness - 25mm thick.

The flame spread index of less than 25 and a smoke developed index of less than 50 for all thicknesses up to and including 1" (25mm) when tested according to ASTM E 84 and CAN ULC S-102.

The AHU Panel insulation shall withstand temperature of 250°F (121°C) when tested according to ASTM C 411. "Test Method for Surface performance of High-Temperature Insulations". At this temperature, the Panel Liner insulation shall show no evidence of flaming, glowing, smoldering, de-lamination, melting or insulation collapse.

AHU Fan section Panels shall be acoustically lined with 25 mm thick acoustic insulation with Armasound foam / Thermal conductivity 0.045 W/m deg.K / density 140~180 kg/m<sup>3</sup>, with manufacturer recommended adhesive 520 bonding.

- 8.7 Coils for shall be copper with aluminium fins designed and tested to 20-kg/sq. cm working pressure. Supply and return connections shall be **65 mm / 50mm O.D copper header** arranged either right or left handed as required. Manual air vents shall be provided on the return headers with a flexible pipe discharging into the drain-pan. End connections shall have valves on the supply & return sides and control valve on return side.
- 8.8 Coil drain pans shall be fabricated out of **1.25 mm S.S.** with sandwiched insulation. Pan shall be large enough to contain the unit and the coil connections shut off valves, solenoid valves etc. Interior of the pan shall be finished smooth and pitch towards 25 mm drain connection located on the both sides of the tray.

The GA and assembly drawings shall be got approved by the Consultant before manufacturing. The units shall be offer for Inspection before despatch.



## **11.0 FANS**

### **SCOPE:**

Scope of this section comprises of supplying, erection, testing, adjusting and commissioning of following type of fans:

- ❖ Propellor type Exhaust fans – For Toilet Exhaust.

The above fans shall be as indicated in the Equipment Summary Sheet and Schedule of Quantities, on drawings and as mentioned in schedule of quantities.

### **GENERAL**

Fans shall be of the type, size, arrangement and capacity as indicated in the schedule and/or as shown on the drawings. Unless specified, fan performance rating data shall be tested accordance with AMCA Standard 210-85 (Air Moving and Conditioning Association), ANSI/ASHRAE Standard 51-1985 "Laboratory Methods of Testing Fans for Rating".

Sound ratings shall conform to AMCA Standard 300-85, "Reverberant Room Method for Sound Testing of Fans". A computer printout of fan performance rating corresponding to the AMCA licensed data, with corrected ratings for altitude and temperature, fan operating speed, bearing life, etc. shall be submitted for approval.

All fans shall be dynamically trim-balanced to ISO1940 and AMCA 204/3 - G2.5 quality grade after assembly. A computer printout with the vibration spectrum analysis shall be attached to the fans.

Fan motors shall comply in all respects with continuous rating in accordance with IEC34 or equivalent. Motor bearings shall be of ball or roller type, grease or lubricant sealed for life.

Fan and drive shall be earthed to prevent accumulation of static charge.

Fans shall be installed at staircase or lobby where fresh air intake is free from any obstruction and shall be energized only by fire alarm system. Fan shall be of Axial Flow Fan or DIDW Centrifugal Fan. Protective grille at the suction of the fan is required.

Anti-condensation heater is recommended to be installed for all Pressurization and Smoke Spill Fans, and the control circuit shall be arranged such the way that the heater is off when the starter is on and vice versa. Heaters shall be wired from the respective local motor control panel or motor control console.

Fan shall be factory assembled and shipped with all accessories factory-mounted.

The Fans shall be installed as per the fan manufacturer's guidelines.

All the fans shall be provided with High temperature special flexible connections should be used to duct connections to the fan.

### **INLINE CENTRIFUGAL DUCT FANS:**

Fan shall be of SISW, forward or backward curved centrifugal, direct driven type. Casing shall

be of Galvanized steel with Oven-baked epoxy coating. Impeller material shall be either galvanized Steel or Glass Reinforced Polypropylene. Motor shall be external rotor type for power supply 220~240V/50Hz/Single Phase.

#### **RECTANGULAR INLINE FAN:**

These low noise fans shall incorporate SISW direct driven centrifugal fans with TEFC (IP-44) motor. The fan assembly shall be encased in a sheet metal housing of 22G GSS and with necessary inspection cover with proper gasket assembly.

The fan material shall be galvanised steel sheet of heavy gauge. Flanges shall be provided on both sides of the inline fan to facilitate easy connection. Flexible anti-vibration joints shall be provided to arrest vibration being communicated to other equipment connected to the inline fan.

Motor shall be single/three phase as per duty conditions required. Capacities and total static pressures should be as mentioned in schedule of quantities.

All single-phase fans shall be provided with speed regulator and three phase fans shall be provided with opposed blade damper in GSS construction at fan outlet for air balancing.

Electrical connections should be external, housed in a self-extinguishing technopolymeric box, resistant to atmospheric agents and with protection degree IP54.

#### **CIRCULAR INLINE FAN:**

These low noise fans should be of specified make and shall incorporate backward curved impeller directly connected with external rotor sturdy motor suitable for continuous operation.

The inline fan construction should be such that it is possible to install the assembly in any position. The casing and the impeller shall be of galvanised steel. Down stream guide vanes of the air outlets should be provided.

The fan motor should be suitable for single-phase electric supply. The motor shall be complete with motor protection through built-in thermal contact and TEFC (IP-54) enclosure. The motor construction shall be such that it is possible to regulate the speed from 100%-10%. The fan assembly shall be reliable and suitable for continuous operation.

Electrical connections should be external, housed in a self-extinguishing technopolymeric box, resistant to atmospheric agents and with protection degree IP54.

#### **AXIAL FLOW FANS (DIRECT DRIVE/ BELT DRIVE):**

Fans shall be licensed to bear the AMCA Air and Sound Certified Ratings Seal. The test standard used shall be ANSI/AMCA 210-85, ANSI/ASHRAE Standard 51-1985 "Laboratory Method of Testing Fans for Rating" and AMCA 300 "Reverberant Room Method for Sound Testing of fans".

Fans shall be oven-baked with polyester coating for minimum thickness of 60 microns or hot-dipped galvanized. To achieve the minimum and equal clearance between the blade tips and casing, tube casing shall maintain its roundness by means of using one piece of sheet metal with 90 edge flanging up.

Fan motor base support shall be properly secured (locked and sealed) to the fan housing and be of adjustable type to have precise control of motor shaft central position as well as running clearance between blade tips and casing. Motor (KW/HP) shall be able to be changed or upgraded at site without changing fan housing or ducting construction.

Fans supplied shall be complete with factory fabricated mounting bracket (ceiling or foot mounted) and suction/discharge matching flanges as accessories.

All hubs shall be cast Aluminum alloy (Grade LM2) unless for Smoke Extractor Fans where high temperature (250C/2Hrs) air is expected then Aluminum alloy or steel fan impeller blades are required. Otherwise impeller blade material with Polypropylene (PP), Glass-reinforced polypropylene (PPG) and Glass-reinforced Polyamide (PAG), to provide self-balancing, anti-static, anti-sparking characteristic is preferable.

Running clearance between blade tips and casing shall not exceed 1% of the impeller diameter, and 2% for smoke spill high temperature fan where mechanical expansion coefficient is different from normal ambient temperature.

Fan manufacturer shall provide the fan assembled with the same clearance between blade tips and casing of the tested prototype. Note that the air performance and pressure loss are greatly affected by this clearance.

Impellers shall be secured to the drive shaft by a key and keyway. Axial location shall be provided by a collar or shoulder on the drive shaft together with a retaining washer and screw fitted into a tapped hole at the end of the shaft and locked in position. Blades shall be secured in place to the angle setting by setscrews, locking nuts or setting pins.

Fan motor shall be totally enclosed and external terminal box of at least IP55 shall be provided. Fans shall not exceed 1500 RPM.

All fans after assembly shall be dynamically trim-balanced to ISO1940 and AMCA 204/3 - G2.5 quality grade. A computer printout with vibration spectrum analysis shall be attached to the fans.

**In case of Belt drives** - Fan impellers shall be driven by V-belts with the pulley keyed to the shaft and retained by taper-bushes. Motor mounting plate shall be supported using four threaded rods for belt tensioning. Belt tunnel shall be sealed from the air stream and belt guards with proper ventilation should be provided.

#### **ACCESSORIES FOR FANS:**

The following accessories shall be provided with all fans:

- 6.1.1 Outlet cone for static pressure regain
- 6.1.2 Inlet cone
- 6.1.3 Fan silencers if required
- 6.1.4 Speed regulators
- 6.1.5 Shutters (back draft)
- 6.1.6 Support brackets
- 6.1.7 Protection guard
- 6.1.8 Collars for duct fixing
- 6.1.9 Silencers if required.

Fan shall be factory assembled and shipped with all accessories factory-mounted.

## **PERFORMANCE DATA:**

All fans shall be selected for the lowest operating noise level. Capacity rating, power consumption with operating points clearly indicated, shall be submitted, and verified at the time of testing and commissioning of the installation.

## **TESTING:**

Capacity of all fans shall be measured by a hot wire anemotherm. Measured airflow capacities shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

## **VIBRATION CONTROL OF EQUIPMENTS:**

1. The equipments shall be statically and dynamically balanced and shall be provided with necessary concrete foundation. The equipments shall be fixed to the foundation/floor through vibration isolators.
2. The duct connection to the air handling equipments shall be through double canvas connection or other flexible connection.

## **12.0 AIR DISTRIBUTION**

### **1.0 SCOPE**

- 1.1 The scope under this section covers air distribution system consisting of :
- a) Fresh Air Ducting with PVC pipes & connecting sheet metal ducting
  - b) Air volume regulator

### **2.0 STANDARDS**

- 2.1 The following standards shall be applicable:
- a) IS : 655 Metal air ducts
  - b) IS : CP352 Mechanical ventilation and air conditioning in buildings
  - c) IS : 2629 Recommended practice for hot-dip galvanising of iron & steel
  - d) SMACNA Standard for low-pressure duct construction

### **3.0 MATERIAL**

- 3.1 The material for sheet metal ducting shall be cold rolled sheets continuous galvanised with zinc coating of total 375 gm per sq.m. for both sides put together conforming to IS : 277. Alternatively HVAC Contractor shall confirm inclusion of class VII sheets of Jindal.
- 3.2 The gasket for duct joints shall be 3mm formed rubber or expanded polyethylene. The bonding material shall be mastic sealant.
- 3.3 The duct flanges and supporting material shall be mild steel structure steel section.
- 3.4 All duct hangers shall be fully threaded galvanised rod with adjustable nuts for levelling and a check nut for safety.

3.5 The material for various applications shall be as follows.

Sr No	Application	Material
1	Ducting for Air-conditioning	Cold rolled sheets continuous galvanised with a zinc coating of 375 g/sq.m both sides inclusive to IS : 277 or class VII
2	Duct for ventilation & exhaust	Cold rolled sheets continuous galvanised with a zinc coating of 375 g/sq.m both sides inclusive to IS : 277 or class VII
3	Supports & duct flanges	Mild steel structural steel sections
4	Gasket	Foamed rubber 3.2mm (1/8")
5	Bonding	Mastek sealant

3.6 All galvanised plain sheets shall be reasonably flat and free from twist. The zinc coating shall be clean, even and free from un galvanised spots. Sheets shall not crack or peel during bending or fabrication. All sheets shall be procured from approved manufactures.

#### 4.0 GENERAL REQUIREMENTS DUCTING INSTALLATION

4.1 The sheet metal ducting shall be installed and supported in the auditorium as per the drawing and the requirement using the necessary GI hangers of suitable size and length fixing them to the structural members of the auditorium.

4.2 Necessary scaffolding should be used for this ducting and hanger installation which shall be considered including its transportation to and from the site, loading, unloading etc and quoted separately under B 1 (d) Air distribution system in BOQ.

4.2 Bidders should visit the site for understanding the site condition for this ductable / package AC and its ducting installation before submitting their quotations / bids.

#### 5.0 DUCT FABRICATION

5.1 Duct construction shall, generally, confirm to IS-655 "Specifications for Metal Air Ducts ". Thickness of sheets for rectangular ducts shall, however, be as follows:

Sr No	Application	Material
1	Upto 750 mm	0.63 mm (24 SWG)
2	751 to 1250 mm	0.80 mm (22 SWG)
3	1251 to 2250 mm	1.00 mm (20 SWG)
4	2251 and above	1.25 mm (18 SWG)

5.2 All galvanised plain sheets shall be reasonably flat and free from twist. The zinc coating shall be clean, even and free from un galvanised spots. Sheets shall not crack or peel during bending or fabrication. All sheets shall be procured from approved manufactures.

5.3 All ducts shall be fabricated from galvanised steel sheets conforming to IS-277 with class VIII (120-175 gms/sq.m) coating. All nuts, bolts and washers shall be of Zinc plated steel and all rivets shall be galvanised. Self-tapping screws shall not be used.

- 5.4 The thickness of all four sides shall be determined by the thickness required for the longest side of the duct from the above Table.
- 5.5 The Flanged joints shall be used at intervals not exceeding 2500 mm using angle iron of size 35 mm x 35mm x 5mm. Flanges shall be welded at the corners first and then riveted to the duct. All flanged joints shall have at least 6mm thick felt lining between the flanges.
- 5.6 Suitable supply and volume control dampers shall be provided in the branch ducts for balancing air quantities. Every damper shall have indicating device clearly showing the damper position at all times. Volume control dampers shall also be provided on the S.A. grilles / diffusers, as specified.
- 5.7 All joints shall be made airtight and all interior surfaces shall be smooth. Bends shall be made with radius not less than one half the width of the duct or with properly designed interior curved vanes.
- 5.8 All ducts shall be supported on angle iron supports of 40 X 40 X 6 mm. In case of ceiling suspended ducts anchor fasteners / hangers of adequate sizes shall be fixed to the ceiling and threaded rods and G.I. straps with spring washers and lock nuts shall be used for holding the ducts. Where ducts cannot be suspended from ceiling, wall brackets or other suitable arrangement shall be adopted. A minimum of 6-mm neoprene or other vibration isolation packing shall be provided between the duct and the angle iron support/ bracket. Where metal ducts or sleeves terminate in woodwork, brick or masonry openings, tight joints shall be made by means of closely fitting heavy flanged collar.
- 5.9 Duct connection to the air-handling units / Ductable IDUs shall be made by inserting a double canvas sleeve 100-mm long. The canvas connection shall be made from 'VIPER' or equivalent fire resistant material. The sleeve shall be securely bent and bolted to the duct and the unit casing.

## 6.0 GENERAL REQUIREMENTS

- 6.1 The sheet metal ducting shall be done for the proper distribution of air in air-conditioned space. The ducting shall be designed on the basis of equal pressure drop and shall incorporate necessary accessories like reducers, bends, splitters, dampers and guide vanes for proper control and smooth airflow.
- 6.2 The selection of air diffusing attachments and their location shall be done to achieve uniform air distribution. The grilles and diffusers shall be painted M.S or aluminium as specified and shown on the drawing.
- 6.3 The ducting shall be supported by means of hangers and shall not rest on the false ceiling.
- 6.4 Duct crossing walls and slabs shall be encased in wooden framework and the openings shall be closed properly unless indicated on the drawing for the purpose of return air.
- 6.5 Volume control dampers of splitter or louvered type shall be provided as shown on the drawings. Additional dampers if required shall be provided for proper balancing of the air distribution system. Fire dampers shall be provided at the AHU outlet and return air inlet to the Air Handling Equipment/room. Additional fire dampers shall be provided as per the codes of local fire authorities.
- 6.6 Access door shall be provided adjacent to the fire, splitter and louvered dampers.

- 6.7 Air outlets shall be selected based on the air quantity, throw and aerodynamic noise power not exceeding NC 30. The location size and shape of the air outlets shall be co-ordinated with interior and false ceiling scheme.

## 7.0 DUCT FABRICATION

- 7.1 The ducts shall be rectangular or circular as indicated on the drawings. The minimum thickness of the sheets shall be as shown below:

Dimensions of Ducts (mm)	Gauge G.I.	Type of Joints	Type of Bracings
Upto 600	24	G.I. Flange at 2.5 centre	Cross bracing
601 to 750	24	25 x 25 x 3mm angle iron frame with 6mm dia nuts & bolts	25 x 25 x 3mm MS angle bracing at 1500mm from joints
750 to 1000	22	25 x 25 x 3mm angle iron frame with 6mm dia nuts & bolts	25 x 25 x 3mm MS angle bracing at 1500mm from joints
1001 to 1500	22	40 x 40 x 5mm angle iron frame with 8mm dia. nuts & bolts	40 x 40 x 3mm MS angle bracing at 1500mm from joints.
1501 to 2250	20	50 x 50 x 3mm angle iron to be cross braced diagonally with 10mm dia nuts & bolts at 125 center	40 x 40 x 3mm MS angle bracing at 1200mm from joints OR 40 x 40 x 3mm MS angle diagonal bracing
2250 and above	18	50 x 50 x 6mm angle iron to be cross braced diagonally with 10 mm dia nuts & bolts at 125 centre	50 x 50 x 3mm MS angle bracing at 1200mm from joints OR 50 x 50 x 3 mm MS angle diagonal bracing

Sheet metal ducts shall be fabricated out of galvanized steel sheets conforming to BIS 655, BIS 277, BIS 737 & SMACNA. Sheets used shall be produced by Hot dip process and galvanizing shall be Class VIII- Minimum Average Coating 120 gm/sq.m as per BIS 277: 1992.

## 7.2 HANGERS FOR DUCT:

Duct Size (mm)	Spacing (M)	Size of GI angle (mm x mm)	Size of GI rod dia (mm)
Upto 750	2.5	40 x 3	8/10
751 to 1500	2.0	40 x 3	10/12
1501 to 2250	2.0	50 x 3	12/15
2251 to above	2.0	50 x 3	12/15

For duct size above 2251 16/18mm GI fully threaded rod shall be used.

- 7.3 The companion flanges and girth angles shall be metered and welded at corners and riveted to the duct at 75mm centres. The longitudinal seams shall be inside groove or Pittsburgh type. The flanged joints shall be made air tight with 3mm rubber or 6mm felt gasket and secured with 10mm GI bolts at 150mm centres. Ducts shall not be cross-broken, if insulated. The seams and joints shall be rendered air tight with mastic sealant.
- 7.4 The elbows shall have a minimum R/D ratio of 1:3. The elbows of R/D rate of less than 1:3 and square elbows wherever provided due to site condition, shall be with equally spaced guide vanes for smooth flow. Splitter dampers shall be provided for all branch splits. All branches, feeding more than two outlets, shall be provided with control dampers.

- 7.5 Capped airflow connections shall be provided, wherever shown, for testing and balancing of air distribution.

## 7.6 FABRICATION:

Ducts should be supplied to the jobsite in prefabricated L form and site fabrication to be limited to suit site pieces and collars/droppers. The L form ducts shall be assembled and installed at site. All ducts shall be fabricated and installed in workman like manner, generally conforming to IS 655. Round exposed ducts shall be die formed for achieving perfect circle configuration.

- a) Ducts so identified on the drawings shall be acoustically lined with thermal insulation as described in the section 'Insulation' and as indicated in schedule of quantities. Duct dimensions shown on drawings are overall sheet metal dimensions inclusive of the acoustic lining, where required and indicated in schedule of quantities.
- b) Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight.
- c) All exposed ducts within conditioned spaces shall have flanged joints. Exposed ducts, where required or as indicated in Schedule of quantities, shall be painted with two coats, of enamel paint of approved colour. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.
- d) Changes in dimensions and shape of ducts shall be gradual. Curved elbows, unless otherwise indicated, shall have a center line radius equal to one and a half times the width of the duct. Air turns shall be installed in all vanes, arranged to permit the air to make the turn without appreciable turbulence. Suitable vanes shall be provided in duct collar to have uniform/ proper air distribution.
- e) Ducts shall be fabricated as per details shown on drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles of sample size to keep the ducts true to shape and to prevent bulking, vibration or breathing.
- f) All sheet metal connections, partitions and plenums required to confine the flow of air to and through 18g GI/16 gauge aluminium, thoroughly stiffened with 25mm x 25mm x 3mm galvanized iron braces & fitted with all necessary doors as required to give access to all parts of the apparatus. Access Doors shall be not less than 45cm x 45cm in size.

## 7.8 FACTORY FABRICATED DUCTS & FITTINGS:

- 1.0 All ducts shall be made out of LFQ (lock forming quality) sheets of prime galvanised iron raw material (in roll form/ coil form) & furnished with mill test certificates. The material for sheet metal ducting shall be cold rolled sheets continuous galvanised with zinc coating of total 120 g /Sq.M. for both sides put together conforming to IS: 277. Approved manufacturer for GSS coil are Jindal / SAIL / TATA. Use of raw material in coil form / rolled form is necessary in order to limit longitudinal joints at the edges, irrespective of the dimensions.
- 2.0 Incase of necessity, samples of sheet selected at random by Client representative shall be tested for thickness & zinc coating at supplier / contractor's expense.



- 3.0 The duct work construction, erection, testing & performance shall be confirming to IS - 655 / SMACNA / DW 144 as applicable – but with sheet thickness for various sizes shall be as described above. 26 G ducting is not allowed unless specifically mentioned.
- 4.0 The factory fabricated ducts can be in full wrap around / L shape duct in standard 4' (1200 mm) length with stiffening beads (every 300 mm) duly sealed on seams & joints & with bracing angles omitted. Ducts larger than 600 mm shall be cross broken. In case of duct lengths increasing beyond 1200 mm, bracing may be required.
- 5.0 Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling and mark sections for re-assembly and coordinated installation.
- 6.0 Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts true-to-shape, and to prevent buckling.
- 7.0 Transform duct sizes gradually, not exceeding 20 deg. divergence and 30 deg. convergence.
- 8.0 All the duct work including straight sections, tapers, elbows, branches, transition pieces, shoe-pieces, collars, droppers, terminal boxes, grill / slot diffuser plenums & transformation pieces shall be factory fabricated with state of art equipment such as de-coiler, Plasma / CNC profile cutters, lock-formers & rollers. Plenums shall be factory fabricated panel type & assembled at site.
- 9.0 Four bolt Rolamate / TDC flange / rolled on TDF flange are acceptable for flanged duct joints. Slips on flanges are not allowed. The flanges shall have a groove arrangement for fixing of gasket. All the transverse duct connectors (flanges / cleats), accessories & related hardware such as support system shall be zinc coated (i.e. galvanised) The Rolamate / TDC flange / rolled on TDF flange system is acceptable upto 1500 mm wide ducts beyond which it is required to have galvanised angle flanges (or tie rod arrangement at 1200 mm distance.)
- 10.0 Ductwork supporting arrangement shall be as per IS-655 as described above in site fabricated ducts. Strap supporting system not allowed for rigid GS ducts.
- 11.0 The ductwork shall be fabricated as per approved drawings & all connecting sections shall be dimensionally matched to avoid any gaps. Dimensional tolerance is + 1.0mm of specified dimension. To obtain perpendicularity, the diagonal tolerance shall also be + 1.0 mm per metre.
- 12.0 Longitudinal seams shall be made airtight and the corners shall be Pittsburgh or snap button punch to ensure air tightness.
- 13.0 Each duct pieces shall be identified by coded label / sticker, which shall indicate specific part no., job name, drawing no, duct size & gauge.
- 14.0 The gauges, joints & bracing for the duct work shall confirm to the provisions as indicated on the approved drawings.
- 15.0 Shop fabricated ductwork shall be in 1200 mm / 1500 mm / 2400 mm lengths, unless otherwise indicated or required to complete runs. Pre-assemble the duct work in shop to a greatest extent, so as to minimize field assembly of systems. Disassemble systems

only to the extent necessary for shipping and handling and mark sections for re-assembly and coordinated installation.

16.0 The duct work supplied & installed shall be free from visual imperfections including pitting, seam marks, roller marks, stains and discoloration and other imperfections, including those which would impair painting.

## **7.9 INSTALLATION:**

All ducts shall be installed generally as per the drawings and in strict accordance with approved shop drawings to be prepared by the Contractor.

- i. The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent, of these specifications and drawings. The work shall meet with the approval of Owner's site representative in all its parts and details.
- ii. All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and/or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained, all as per the site requirements.
- iii. If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points by any path available, in accordance with other services and as per approval of Owners site representatives.
- iv. All duct work shall be independently supported from building structure. All horizontal ducts shall be rigidly and securely supported, in approved manner with trapeze hangers formed of GI rods and galvanized angle iron under ducts at not greater than 2-meter centers. All vertical ductwork shall be supported by structural members at each floor. Air conditioning contractor shall supply and install 50mm cube MS boxes with 10mm dia steel rod passing through box, all given two coats of red oxide paint, the MS rod tied with reinforcement bar at point of suspension shall be neatly exposed.

If duct is passing through in such areas where space between ceiling slab to false ceiling is more than 1500 mm then duct should be supported by wall mounted brackets of 40 x 40 x 3 mm galvanized angles.

- v. Ducting over furred ceiling shall be supported from the slab above, or from beams, after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractors on the building.
- vi. Where metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitted heavy flanged collars. Where ducts pass through brick or masonry opening and wooden frame work shall be provided within the opening and crossing ducts provided with heavy flanged collars on each side of wooden frame work, so that duct crossing is made leak-proof.
- vii. All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibrations in the ducts, ducts shall be provided of closely woven, rubber impregnated double layer asbestos/canvas or neoprene coated fibre glass fire resistant flexible connection. The flexible connections located close to the unit, in mutually perpendicular

directions. The flexible sleeve at least 10cm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

- viii. Air conditioning unit and exhaust fans shall be connected to duct work by inserting at air inlet and air outlet a double canvass sleeve. Each sleeve shall minimum 150 mm securely bolted to duct and the connecting duct work rigidly held in line with unit inlet or outlet.
- ix. Necessary wall/slab openings making and redoing for erection of equipment, ducts and piping to be in HVAC Contractors scope whether specifically excluded/not mentioned elsewhere.
- x. Ducts shall have neoprene rubber gasket in between at each flange joints.

## 8.0 DAMPERS & GUIDE VANES

8.1 The GUIDE VANES shall be provided as shown below:

- a) At every non-split branch take off
- b) At every bend/elbow of less than 1.3 R/D ratio
- c) At first 4 collars after the fans and first two collar after every bends.

The vanes shall be double walled and properly curved for smooth air flow and change in direction of flow and shall be fabricated out of 0.8 mm GI sheets. The vanes shall be fixed to the side runners at equidistant and reverted/bolted to the ducts.

8.2 The SPLITTER DAMPERS shall be double walled aerofoil blade fabricated out 1.6mm (16 SWG) GI sheet. The damper shall be complete with flanged sheet metal enclosure to suit the upstream and down stream duct connections, hinge at the down stream and operating rod at the upstream end. The GI enclosure shall be one size thicker than the up stream duct.

8.3 The LOUVRED DAMPERS shall be multi blade aerofoil construction with opposed/parallel blades of maximum 250 x 1200 mm size. The blades shall be mounted on 50mm channel with suitable gang operated linkage and operating rod. The operation rod shall be terminated in a locking quadrant with position indicator.

8.4 The FIRE DAMPERS shall be rated for 2 hrs. fire resistance conforming to BS : 476-1 and CP-413 and shall be housed in a GI sheet enclosure flanged at both ends and shall include the damper blades, fusible link, holding spring, manual adjustable handle etc. The material for fabrication of fire dampers shall be as shown below:

- a) Damper blades - 3mm (10 SWG) Galvanised sheet steel
- b) Casing - 2mm (14 SWG)
- c) Bearing - Sintered
- d) Spring - SS 304
- e) Fusible link - Set for 70 deg C fusing temperature

8.5 All dampers larger than 1200 mm width shall be fabricated in multiple sections. The damper rods shall be MS epoxy coated with bronze bushes at one end and locking quadrant with damper position indicator at the other end. The damper rods shall extend beyond the enclosure frame and insulation wherein provided.

8.6 The access doors for dampers shall be 400 x 400mm steel bolted with rubber gasket.

## 9.0 AIR OUTLETS

- 9.1 The air outlets shall be grille or diffuser type as indicated on the drawing. The grilles and diffusers shall be aluminium powder coated as shown on the drawing and schedule of material.
- 9.2 Supply air grilles shall be double deflection type with horizontal face bars and vertical rear bars placed in a rigid marginal frame. Bars shall be shaped and spaced at 18mm centres with swaged pivot pins positively holding the deflections setting under all conditions of velocity and pressure. All grilles shall be provided with integral opposed blade, grille face kept-operated dampers.
- 9.3 Return grilles shall have fixed face bars shaped and set at 18mm centres. Bars shall be set at 5-degree deflection for vision proof installation. The grilles shall be complete with rigid marginal frames and shall be matching with the supply grilles.
- 9.4 Ceiling diffusers shall be round/square/rectangular face flush type horizontal air diffusion pattern. Diffusers shall have ample margins to minimise ceiling smudge. Half diffusers shall be provided with face operated volume control dampers. Half diffusers shall be similar to full diffusers.
- 9.5 All duct collars terminating on to a grille or diffuser shall be given two coats of black paint for a length of 300mm.
- 9.6 Aluminium grilles and diffusers wherever specified shall be of extruded aluminium with margins & GSS butterfly dampers. Grilles shall have horizontal face bars only.
- 9.7 Linear diffusers/grilles shall be die formed, flush mounted type with single or double directional air flow. The diffuser/grille shall be in a frame with minimum 20mm margin. All linear air diffusing equipment shall be fitted with a distribution sheet metal plenum as shown on the drawings.

## 10.0 AIR INTAKES & EXHAUST OUTLETS

- 10.1 The outside air intakes and exhaust air outlets shall consist of louvers, bird screen and enclosure, the total assembly fitted into wall with clear opening and the edges sealed with ALITUS Group sealant.
- 10.2 The sheet metal enclosure shall be made out of 1.25mm GI sheets flanged at both ends and with minimum 4 hold fast. The enclosure shall be minimum 250mm long or 100mm more than the width of the wall.
- 10.3 The louvers shall be 100mm wide mounted at 45 deg. and spaced at 100mm centres and shall be fabricated out of 1.25mm GI sheets.
- 10.4 The bird screen shall be made out of 15 x 15mm 1.0 mm GI wire mesh inset with 0.8mm GI frame and bolted to the enclosure flange at 150mm centres using 12mm MS brass bolts and nuts.

## 11.0 INSTALLATION

- 11.1 The ducts shall be supported at the traverse joints as indicated below:
- |                       |                                       |
|-----------------------|---------------------------------------|
| a) Upto 1800 mm       | 40x40x3mm M.S angle with 10mm tie rod |
| b) 1801 mm to 2400 mm | 40x40x6mm M.S angle with 10mm tie rod |
| c) 2401 mm and above  | 50x50x6mm M.S angle with 10mm tie rod |

- 11.2 Additional supports wherever considered necessary by the Consultant / Engineer - in-charge shall be provided. Supports shall be taken from steel members grouted in the RCC work and fixing of steel members shall involve minimum damage. The entire supporting system shall be meet with the approval of the Engineer-in-charge.
- 11.3 All duct supports, flanges; hanger shall be given two coats of red-oxide before installation and one coat of aluminium paint after erection.
- 11.4 Where ducts are connected to the wall, such connections shall be made through mild steel frame fixed to the wall through suitable shear fasteners.
- 12.0 INSTALLATION
- 12.1 The ducts shall be routed as shown on the drawing or as instructed. Working drawing shall be got approved before taking up the fabrication and erection.
- 12.2 Ducts connecting to air moving apparatus shall be through 15 oz. mildew resistant double canvas as directed by the Engineer. On all circular spigots the flexible material is to be screwed or clip band with adjustable screw or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat. The flexible connection shall not be less than 75mm and not more than 200mm.
- 13.0 TESTING & BALANCING
- 13.1 The entire air distribution shall be adjusted and balanced for delivery of design air quantities or as required for achieving design space conditions. After all adjustments are made, the air readings shall be recorded on the drawings vis-a-vis the space conditions. All dampers after adjustment shall be set and locked in position. All air and static pressure measurements shall be done through probe type meters. Vane type meter readings are not considered reliable.

## **FABRIC DUCTS:**

Fabric Air Dispersion System comprises of Non-metal Fabric air dispersion system as described in this section and as per the ducting layout drawings. The Fabric Ducts are made of fire resistant woven fabric and suspension system.

### **Standards and code compliance:**

- Fabric air dispersion system shall adhere to flame spread and smoke developed index less than 25/50 respectively when evaluated in accordance to UL723 and CAN / ULC S102, latest revision.
- It shall comply with the flame spread and smoke Developed index of less than 25/50 as per NFPA90- A, latest revision.

### **Submittals:**

- Documentation for compliance with NFPA90, latest revision, showing flame spread and Smoke developed index less then 25 / 50 respectively when tested in accordance to both UL723 and CAN / ULC S102, latest revision.

### **Warranty:**

Manufacturer shall provide **10 year product warranty**.

### **Delivery:**

Fabric air dispersion system shall be properly packaged during shipping; handling and storage to prevent damage Product shall be stored in indoor location, and protected from weather.

## **Products Data**

Ducts shall be constructed out of Fabric constructed of an inherent fire resistant woven fabric Comply with following physical characteristics:

- Fabric shall be constructed of 100% inherent fire resistant polyester yarn.
- Fabric shall meet flame and smoke requirement of NFPA90 and ULC S102 standards.
- Fabric weight shall be 230-250 g/m<sup>2</sup> (5.5-8 oz/yd<sup>2</sup>) tested per ASTM D3776, latest Revision.
- Fabric shrinkage shall be less than 0.5%.
- Fabric permeability: precision permeability for each application is confirmed by design system requirements.
- Permeability ranges: 0-200mm/s covers four different type model of Air dispersion.

Fabric shall be inherent fire resistant. Fire retardant treated fabric is not acceptable.

## **System Fabrication:**

Air is discharged through mesh vent, linear vent and / or fabric permeation. Location and dimension of vents shall be approved by manufacturer. Inlets are to be connected to metal duct via anchor patches supplied by manufacturer.

## **Zip**

Screw fastener used for secure inlet anchor patches are to be supplied by contractor. Zipper connection shall be used to connect inlet, end cap and duct segments when deemed necessary by manufacturer for easy removal and maintenance.

ACD (Airflow Control Device) and PAD (Pressure Adjustment Device) shall be included for airflow and pressure adjustment as specified by manufacturer system shall include connectors to attach to suspension system listed below.

## **Design:**

Fabric air dispersion system shall only be used for positive pressure situation in the mechanical ventilation system System shall not be used in concealed space.

System shall be designed to work with inlet static pressure from 70 Pa, or 0.25" water gage To 750 Pa, or 3" water gage, with standard pressure of 120 Pa, or 0.5" water gage.

Designed temperature shall be between -53. – 100 Deg Cen (-63. – 212 Deg Fahrenheit.). System length, diameter, static pressure and airflow shall be approved by manufacturer.

## **Suspension System: (Option to be provided as per site requirement)**

a) Galvanized Tension Cable:

Suspension system consists of one row or two rows of plastic coated galvanized cables located 25mm to 100mm (1" to 4") above fabric duct mounting points.

Mounting points shall locate at 12 o'clock (for single row suspension), and options of 10, 2 o'clock, and 9, 3 o'clock positions (For double row suspension).

Distance between clips shall not exceed 609mm (24").

Double row suspension is recommended for ducts with diameter larger than 610 mm (24"). Cable and accessories include eye bolts, turnbuckles, cable clamps, gripple hanger shall be Supplied by manufacturer.

Mounting bracket at both ends of tension cables shall be supplied by installer.

b) Stainless Steel Tension Cable:

Suspension system consists of one row or two rows of plastic coated stainless steel cables located 25mm to 100mm (1" to 4") above fabric duct mounting points.

Mounting points shall locate at 12 o'clock (for single row suspension), and options of 10, 2 o'clock, and 9, 3 o'clock positions (for double row suspension). Distance between clips shall not exceed 609mm (24").

Double row suspension is recommended for ducts with diameter larger than 610 mm (24"). Cable and accessories include eye bolts, turnbuckles, cable clamps, gripple hanger shall be supplied by manufacturer.

Mounting bracket at both ends of tension cables shall be supplied by contractor.

c) Suspended H-Track:

Suspension system consists of one row or two rows of aluminum H-track with slots on top and Bottom located 25mm to 100mm (1" to 4") above fabric duct mounting points.

Mounting points shall locate at 12 o'clock (for single row suspension), and options of 10, 2 o'clock, and 9, 3 o'clock positions (for double row suspension).

Distance between clips shall not exceed 609mm (24").

Double row suspension is recommended for ducts with diameter larger than 610 mm (24") Track and accessories include track connectors, end-block, vertical support kits, shall be Supplied by manufacturer.

d) Surface mount N-Track:

Suspension system consists of one row or two rows of aluminum N-track with slot on the bottom, located 25mm to 100mm (1" to 4") above fabric duct mounting points.

Mounting points shall locate at 12 o'clock (for single row suspension), and two edges of half round ducts (for double row suspension). Distance between clips shall not exceed 609mm (24"). Mounting on the duct has the option of detachable slide clip or corded edge.

Track and accessories include track connectors, end-block, and shall be supplied by manufacturer.

### **3. Installation Process:**

a) Fabric Air Dispersion System Installation:

- Exam designated installation space, avoid interference with existing piping, fixtures, and structures.
- Install suspension system as per manufacturer's instruction. Installation manual shall be supplied with product by manufacturer.

b) Maintenance and cleaning:

- Disposable latex gloves are recommended to be worn to prevent soil the product Air handler and any upstream sheet metal ductwork shall be cleaned, and ensure free of dust and other foreign particles before the fabric air dispersion system is connected.
- Fabric ducts shall be removed and cleaned in accordance to manufacturer's guidance if it is soiled before installation finishes.

#### **Acceptable Manufacturer:**

a) DurkeeSox Fabric Air Dispersion System Ltd , represented in India by M/s. Nutech Ducting Solutions Pvt. Ltd., Pune.

b) Euro Air, Denmark represented in India by M/s. Koncept Engineers, Bangalore

### **13.0 REFRIGERANT PIPING:**

- 1 Refrigerant piping shall be Type-L-Copper piping.

- 2 All copper piping shall be type 'L' ASTM B-38 or table 'Y' BS 287 Part I -1971 conforming to the following:

NB (mm)	Min. O.D. (mm)	Thickness (mm)	Working Pressure (M/sq. mm)
8	7.965	0.8	13.6
12	11.965	0.8	8.7
15	14.965	1.0	8.7
22	21.975	1.2	6.9
28	27.975	1.2	5.5
35	34.99	1.5	5.4

All fittings shall be cast bronze for flared connections. Copper piping shall be carried out only where final equipment connections are to be made as advised by the Engineer-in-charge.

- 3 Pipe size shall be as shown on the drawing or should follow the following criteria.

Suction line: Pressure drop not exceeding equivalent to 1.0 deg. C

Liquid lines: Pressure drop not exceeding equivalent to 0.5 deg. C

Discharge lines: Pressure drop not exceeding equivalent to 0.5 deg .C

- 4 All suction and liquid lines shall be lapped and together insulated as specified under "THERMAL INSULATION".

## 5 CLEANING

- 5.1 The pipe shall be thoroughly cleaned internally and externally during the fabrication, assembling and completion of the entire piping work using compressed air, clean water etc.

- 5.2 Necessary detergents shall be used while cleaning and flushing the piping system. Strainer buckets shall be removed while cleaning the system and in-line instruments, traps etc. shall be isolated.

## 6 CORROSION TREATMENT

- 6.1 The pipe assembly shall be provided with outer coating to prevent corrosion.

- 6.2 The pipe laid above ground shall be provided with the following anti corrosive coating.

- a) Two coats of paint of approved colour over two coats of red-oxide primer for M.S. pipe.
- b) Two coats of paint of approved colour for GI piping.

- 6.3 Pipes exposed / laid under ground or concealed in building structure shall be wrapped with **PYPKOTE 4 mm thick polymeric corrosion protection tape with overlapping fusion joints.**

## 7 TESTING

- 7.1 All piping shall be pressure tested by filling water removing air locks and applying pressure using hand or hydraulic test pump unless otherwise specified.



- 7.2 The test pressure shall be equivalent to the higher value of the following:
- Minimum 10 kg/sq.cm
  - Twice the dynamic head of the pump gravity head due to expansion tank, cooling tower etc.
  - 2.5 times the no delivery head of the pump.
- 7.3 The pressure shall be maintained for a minimum period of 2 hrs. and achieve pressure drop with in 0.5 kg/cm sq.
- 7.4 The testing shall be carried in section by blocking both ends or closing the valves, if provided. After completion, the entire installation shall be once again defective material and workmanship.
- 7.5 After commissioning the system, each valve shall be tested for effective working by closing and opening a number of times.
- 7.6 The piping coming under IBR or any local authorities regulator shall be tested according to the clause laid under each regulations.

All testing shall be carried out in presence of the owner/consultants and test register shall be maintained water, labour, equipments and register required for the testing shall be the responsibility of the contractor.

- 7.8 The contractor shall make all arrangements for testing and removal after testing of all water, connections, if any, without causing any damage to the property of the employer or any other contractor.
- 7.9** After the entire piping has been tested and equipment connected, the system of water piping shall be filled and drained till all the dirt and any other foreign matter is flushed out to the satisfaction of the Engineer-in-charge. At any rate, the system shall be flushed out to the satisfaction of the Engineer-in-charge. At any rate, the system shall be flushed at least 3 times before commissioning. All strainers shall be cleaned of all accumulated dirt before the system is charged.

## **14.0 MOTIVE & TRANSMISSION EQUIPMENTS**

### **1.0 SCOPE**

- 1.1 The scope of this section covers motive equipments such as:
- Motors,
  - Pulleys
  - Drive belts

### **2.0 STANDARDS**

- 2.1A The following standards shall be applicable:
- IS : 325 3 Ph. Induction Motors
  - IS : 996 1 Ph. small AC and universal electric motors
  - IS : 900 COP for installation & maintenance of induction motors
  - IS : 1231 Dimensions of foot mounted induction motors
  - IS : 2223 Dimensions of flange mounted induction motors
  - IS : 2253 Type of construction and mounting of motors
  - IS : 4029 Guide for testing 3 Ph. induction motor
  - IS : 4722 Rotating electrical machinery
  - IS : 4691 Degree of protection provided by enclosure for rotating electrical machinery
  - IS : 4728 Terminal marking for rotating electrical machines

K) IS :	3003	Carbon brushes for electrical machines
L) IS :	6362	Designation of the method of cooling of rotating electrical machines
M) IS :	3142	V-grooved pulleys for V belts give sections A, B, C, D & E
N) IS :	2949	V belts for industrial purpose
O) IS :	2122	COP for selection, storage, installation and maintenance of belts for power transmission

## 2.1B LIST OF OTHER INDIAN AND SAFETY STANDARDS TO BE COMPLIED WITH AS APPLICABLE

- I.S. 277 - Galvanised steel sheet.
- I.S. 655 - Metal Air Ducts.
- I.S. 732 - Code of Practice for Electrical Wiring and Fittings for buildings.
- I.S. 778 - Gun Metal Gate, Globe and Check Valves for general purposes.
- I.S. 1239 - Mild Steel Tubes, Tubular and other wrought Steel Fittings.
- I.S. 1248 - Direct Acting Electrical Indicating Instruments.
- I.S. 1554 - PVC Insulated (heavy duty) Electric Cables for working voltage upto and including 1100 Volts. (Part – I)
- I.S. 1520 - Horizontal Centrifugal Pumps and for clear, cold, fresh water.
- I.S. 1822 - Motor Starter of Voltage not exceeding 1000 Volts.
- I.S. 2208 - HRC Cartridge Fuse-Links up to 650 Volts.
- I.S. 2516 - A.C. Circuit Breakers.
- I.S. 3589 - Electrically welded steel pipes for water, Gas and Sewage.
- I.S. 3624 - Bourden Tube Pressure and Vacuum Gauges.
- I.S. 4047 - Heavy Duty Air breath switches and composite units of air break switches and fuses
- for voltage not exceeding 1000 volts.
- I.S. 6892 - Steel pipe flanges.
- I.S. 7403 - Code of Practice for Selection of Standard Worm and Helical Boxes.
- I.S. 8148 - Specification for packaged air conditioning.

## LIST OF SAFETY STANDARDS

- I.S. 618 - Code of practice for safety and health requirement in Electrical and Gas welding and cutting operations.
- I.S. 659 - Safety code for Air Conditioning.
- I.S. 660 - Safety code for Mechanical Refrigeration.
- I.S. 3016 - Code of practice for fire precautions in welding and cutting operations.
- I.S. 3210 - Code for safety procedures and practices in Electrical works.
- I.S. 3696 - Safety for Scaffolds and Ladders.

INDIAN ELECTRICITY RULES 1956.

## 3.0 GENERAL REQUIREMENTS

- 3.1 The motors and transmission equipments shall be suitable for the motive power required and the speed of the equipment to be driven.
- 3.2 For air handling equipments desired to run for 24 hrs. Shall be provided with 2 nos. motive and transmission equipment.

## 4.0 MOTORS

- 4.1 The motor shall conform to the details shown on the equipment data of the equipment driven and shall be designed for an average ambient of 45 degree C with a peak of 50 degree C.
- 4.2 The motors shall be squirrel cage induction upto and including 200 hp unless otherwise indicated. The motors shall be suitable for continuous operation round the clock and statically and dynamically balanced to achieve smooth operation and low noise level.
- 4.3 The enclosure shall be of cast iron having a minimum degree of protection as shown below.
- a) Refrigeration units
  - b) Air handling equipment
  - c) Fans
- 4.4 The stator and rotor cores shall be made out of high quality magnetic steel stampings of high permeability and low loss. The stator winding shall be with synthetic enamelled copper wire with slot insulation of minimum class B insulation. The rotor winding shall be of caged construction with copper or copper alloy bars brazed to end ring of same material. The motors shall be with shaft-mounted fans for cooling the windings.
- 4.5 The shaft shall be of high-grade tensile steel suitable for heavy duty. The bearing at the free end shall be ball type at free end and roller type at the load end.

#### 5.0 PULLEYS

- 5.1 The pulleys shall be of heavy duty M.S or Cast Iron with flat grooves.
- 5.2 The pulleys shall have taper lock hub with 2 grub screws for tightening and 1 grub screw for loosening.

#### 6.0 DRIVE BELTS

- 6.1 The drive belts shall be flat-belts suitable for industrial purpose. The size and number of belts shall be according to the power to be transmitted. The belt safety factor shall be not less than 2.5.

#### 7.0 INSTALLATION

- 7.1 The motors shall be directly coupled to the equipment. However, indirect driven equipments are acceptable provided it is essential for the proper performance of the equipment and owing to the space restrictions.
- 7.2 The motor and the equipment shall be mounted on a common base frame. The direct driven equipments shall be provided with flexible couplings. The couplings and the belt and pulley assembly shall be provided with suitable safety guards.

#### 8.0 TESTING

- 8.1 The motors shall be meggered to record a IR value of not less than 1 megohm. The direction of rotation of the equipment to be checked before putting the equipment to operation. The no load and full load currents to be recorded.

### **15.0 NOISE AND VIBRATION CONTROL**

- 1.0 SCOPE
- 1.1 The scope under this section covers control of noise and vibration for the equipments and installation.
- 2.0 STANDARDS
- 2.1 The following standards shall be applicable:
- a) IS:1950 COP for sound insulation of non-industrial buildings
  - b) IS:3483 COP for noise reduction in industrial buildings
  - c) IS:4954 Recommendations for noise abatement in town planning.
- 2.2 In addition to the above standards any other standards prevailing and the general construction and installation practices shall be applicable for the control of noise and vibration.
- 3.0 GENERAL REQUIREMENTS
- 3.1 The equipments and the installation shall be selected, designed and erected such a way that the noise and vibration is minimum where the noise level is high necessary precaution to be taken in the selection of the equipments and necessary acoustic treatment to be provided. Similarly where the vibration is high necessary isolator shall be provided to minimise the transmission of the vibration to the structure or other areas.
- 4.0 NOISE CONTROL
- 4.1 The equipments shall be selected for low noise level especially on handling equipments. Fan and drive motors shall be statically and dynamically balanced and provided with proper bearings. The sound pressure level should not exceed NC 60.
- 4.2 The fan coil and air handling unit R.A plenum shall be acoustically insulated. The supply and return air ducts shall be acoustically insulated for a minimum length of 3m or as shown on the drawing with 25mm thick fibre glass crown 200 covered with 28 G perforated aluminium sheet. The sheet metal duct shall be increased accordingly to accommodate the insulation and get a clear ducts size indicated on the drawings.
- 4.3 The acoustic treatment of equipment rooms shall be by providing acoustic insulation of walls and ceiling as shown on the drawing. Resin bonded glass wool of 32-kg/cu.m density and 50 mm thickness shall be laid over bitumen bonding and wooden framework covered with 50% perforated 28 SWG GI sheets of 3 mm perforation.
- 4.4 **ACOUSTIC LOUVERS:** All openings in the wall and ceiling or those behind the return air grills in cabins, conference rooms, training halls shall be provided with 30/50 mm deep 3-bend (multiple louvers) GI sheet 22SWG stuck with 25 mm thick resin bonded fibreglass covered with 22 SWG perforated aluminium. The space between adjacent louvers shall not exceed 70 mm.
- The excess of the area of the continuous return air grill shall be blanked-off with 22 SWG sheet and painted black.
- 4.5 The velocity of air inside the ducts shall be limited to 9 m/sec. for main ducts and 7.5 m/sec. for branch ducts. The grilles shall be selected such that the noise pressure level should not exceed NC 35 for conference, meeting and guest rooms, NC 55 for public areas.

## 5.0 AIR TIGHT DOORS

- 5.1 The air handling equipment room shall be provided with air tight doors. The doors shall be made of 14 SWG MS frame and 50 mm hollow door panels of 16 SWG MS filled with normal density resin bonded glass wool. There shall be double acoustic seal at the hinged side of the door and single seal at the other sides. The latch shall be positive pressure with adjustable strike and push rod release. The leakage shall not exceed 0.2 cmh/sq.m.

## 6.0 VIBRATION CONTROL

- 6.1 The equipments shall be statically and dynamically balanced and shall be provided with necessary concrete foundation. The equipments shall be fixed to the foundation/floor through vibration isolators.
- 6.2 The pipe connection to the pumps and other vibrating equipments shall be through flexible connection and necessary flexible hangers shall be provided for the pipe support near the equipments.
- 6.3 The duct connection to the air handling equipments shall be through double canvas connection or other flexible connection.
- 6.4 The equipment foundation shall be provided by other agencies based on the foundation drawing furnished by the air conditioning contractor. Necessary supervision during the construction of foundation and grouting of anchor/foundation bolts etc. shall be the responsibility of the air conditioning contractor.

## 16.0 THERMAL INSULATION

### 1.0 SCOPE

- 1.1 The scope under this section covers thermal insulation of pipes, ducting, roof and walls.

### 2.0 STANDARDS

- 2.1 The following standards shall be applicable:

- a) IS: 7240 COP for application and finishing of thermal insulation material at temp. between 80 deg. C to 40 deg. C.
- b) IS: 7413 COP for application and finishing of thermal insulation material at temp. between 40 deg. C to 700 deg. C.
- c) IS: 10556 COP for storage and handling of insulation material
- d) IS: 3346 Method of determination of thermal conductivity of thermal insulation material.
- e) IS: 3690 Specification for glass wool mats for thermal insulation
- f) IS: 4671 Specification for expanded polystyrene for thermal insulation purposes
- g) IS: 8183 Specification for bonded mineral wool
- h) IS: 702 Specification for industrial bitumen

### 3.0 GENERAL REQUIREMENTS

- 3.1 The material and thickness for insulation shall be as specified and shown on the bill of material. The thermal conductivity and the equivalent thickness of insulation shall be as shown below:

	Material	Density	K Value	Equivalent Thickness
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Sr No				mm	mm	mm	mm
1	Resin bonded glass wool	32	0.037	125	100	50	30
2	Expanded polystyrene TF-quality	18	0.0325	100	75	50	25
3	Expanded polyurethane	32	0.025	80	40	40	20
4	Rigid phenolic foam	32	0.022	70	50	25	20
5	Resin bonded mineral wool	48	0.041	125	100	60	30
6	Expanded Polyethylene foam	30	0.035	100	75	80	30

- 3.2 The insulation, bonding and the vapour barrier shall be suitable for the temperature of the surface to be insulated and the location.
- 3.3 All wooden batten and plug used shall be teak wood ant termite treated with 3 coats of shalimar clear liquid. All screws shall be of GI, brass or powder coated.
- 3.4 All surfaces to be insulated shall be thoroughly cleaned and dusted before applying the insulation and bonding material. The bonding material shall applied to both surfaces to be bonded.
- 3.5 The pipe insulation shall be carried out using performed circular/semi circular pipe sections of internal diameter matching the external diameter of the pipe.
- 3.6 Air pocket between the surface and insulation or between insulations shall not be acceptable. All joints shall be staggered and filled with bonding material.
- 3.7 Minimum 50mm overlapping shall be provided for joints in vapour barrier and cladding.
- 4.0 MATERIAL
- 4.1 The material for cold insulation shall be as shown below:
- Fire inhibiting expanded polystyrene of density 18 kg/cum having thermal conductivity not exceeding 0.035 w/mk at 10 deg.C mean temperature conforming to IS : 4671.
  - Expanded polyurethane foam of density 32 kg/cum having thermal conductivity not exceeding 0.025 w/mk at 10 deg. C mean temperature conforming to BS specification.
  - Rigid phenolic foam of density 32 kg/cum having thermal conductivity not exceeding 0.022 w/mk at 10 deg.C mean temperature conforming to BS:3927 with 50 micron aluminium foil fixing.
  - Expanded polyethylene foam of density 30 kg/cum having thermal conductivity not exceeding 0.035 w/mk at 10C mean temperature.
- 4.2 The material for hot insulation shall be as shown below:
- Resin bonded glass wool of density 32 kg/cum having thermal conductivity not exceeding 0.037 w/mk 60 deg C mean temperature
  - Expanded polyurethane foam of density 32 kg/cum having thermal conductivity not exceeding 0.025 w/mk at 10 deg. C mean temperature conforming to BS specification.
  - Rigid phenolic foam of density 32 kg/cum having thermal conductivity no exceeding 0.022 w/mk at 10 deg.C mean temperature conforming to BS:3927 with 50 micron aluminium foil fixing.

- d) Resin bonded mineral wool of density 48 kg/cum having thermal conductivity not exceeding 0.041 at 10 deg C mean temperature conforming to IS : 8183 with 50mm

4.3 The material for fixing vapour barrier and other material shall be as shown below:

a) BONDING MATERIAL

- i) Industrial bitumen-85/40 and 85/25 conforming to IS: 702.
- ii) GI chicken wire mesh - 20 mm 24 SWG.
- iii) CPRX compound.
- iv) 18 SWG GI binding wire.

b) VAPOUR BARRIER

- I) Aluminium foil 50 micron.
- ii) Aluminium cladding 28 SWG for pipe and 6 SWG for wall.
- iii) 2mm PYPKOTE with aluminium foil finish for surface exposed to weather.
- vi) 4mm PYPKOTE polymeric corrosion tape for anticorrosion treatment for underground application.

c) FIXING MATERIAL

- i) Bituminised wood balk 50 x 50mm thick insulation and 50 x 100 up to 150mm thick insulation.
- ii) GI brass or powder coated.

5.0 INSULATION THICKNESS

5.1 The thickness of insulation and the cladding material for various utilities shall be as specified under each section.

6.0 DUCT INSULATION

6.1 The insulation and cladding for ducting work shall be as shown below:

Sr No	Pipe	Layer & Thickness	Material Cladding
A	<u>COLD INSULATION</u>		
1	<u>REFRIGERANT SUCTION</u>		
a	+ 3 Deg C. suction	2 x 50	Nitrile Foam Spl. Adhesive / Al. Foil
b	- 5 Deg C. suction	2 x 75	Nitrile Foam Spl. Adhesive / Al. Foil
c	- 20 Deg C. suction	2 x 100	Nitrile Foam Spl. Adhesive / Al. Foil
2	<u>CHILLED WATER CIRCUIT</u>	1 x 50	Expanded Polystyrene Al. Foil
3	<u>COOLING COIL DRAIN</u>		
a	10 Deg.C	1 x 25	Expanded Polystyrene Al. Foil
b	3 to 5 Deg. C	1 x 100	Expanded Polystyrene Al. Foil

## 7.0 CEILING/WALL INSULATION

7.1 The ceiling/wall insulation shall be as shown below :

<b>Sr No</b>	<b>Surface</b>	<b>Layer &amp; Thickness</b>	<b>Material Cladding</b>
1	Exposed concrete wall	1 x 50	Expanded Plaster Polystyrene
2	Exposed concrete wall	1 x 30	Polyurathene Foam
3	Exposed GI or ACC roof A/c sheet	1 x 75	Expanded Polystyrene
4	Exposed Wall	1 x 50	Expanded Plaster Polystyrene
5	False Ceiling	1 x 50	Resin bonded Fibre glass tissue glass wool

## 8.0 APPLYING INSULATION

### 8.1 REFRIGERANT PIPING SYSTEM

8.1.1 Apply CPRX compound uniformly at 1.5 kg/sq.m on the pipe surface and internal surface of the insulation pipe section, hold them together and apply pressure till the bond is made. Additional layers shall be done on similar basis by applying CPRX on the outer surface of previous layer of insulation and the internal surface of the additional layer. All joints on vertical as well as horizontal shall be staggered.

8.1.2 A vapour seal of hot bitumen at 2.5-kg/ sq.m shall be applied uniformly on the final surface and finished smoothly with aluminium foil. Pairs of semicircular wooden supports shall be provided for fixing the pipes. There is no need of additional foil insulation sections are with aluminium foil finish.

8.1.3 The REF. PIPES exposed to ambient shall be clad with shalikote or 4mm PYPKOTE.

## 9.0 GI OR ACC ROOFING

9.1 The thickness of insulation required is 120mm resin bonded glass wool unless otherwise specified.

9.2 Weld 25 x 3 x 130mm M.S flats with 6mm hole at the free end to the purlins at intervals not exceeding 750mm. Apply 3mm bitumen to the roofing material & one coat to the insulation. Press the insulation against the roof till the bonding is achieved.

9.3 Make GI melting in cross bind pattern to hold the insulation. Clad the insulation with FRP tissue sheet or aluminium foil applying bitumen on the insulation as well as the cladding material.

9.4 Care shall be taken the close all openings especially for corrugated sheets to ensure stoppage of hot air through the opening/corrugation space place ACC sheet, if required, shall be provided below the insulation to avoid entry of heat & to hold the insulation in position. The ACC sheets shall be considered as separate item unless otherwise indicated in the bill of material.

## 10.0 WALLS

10.1 The thickness of insulation required is 50mm expanded polystyrene unless otherwise specified.



- 10.2 Make wooden framework at 600 to 750 mm centres on ceiling slab by fixing 50 x 50 wooden battens using 75mm long wooden screws and self-expanding nylon timbles. Clean the surface of slab and apply 3mm high softening grade R 85/25 bitumen. Apply one coat of bitumen on the bonding surface of the insulation and press against the slab till the bonding is achieved.
- 10.3 Fix 18 SWG 100 x 100 mm GI washers at the junction of the wooden frame work and made GI melting in cross binding pattern to hold the insulation.
- 10.4 The insulation provided above false ceiling and non-visible areas need not have clad unless otherwise specified. The insulation provided in the visible areas shall be plastered by other agencies after providing chicken wire mesh.
- 10.5 The thermal insulation for the walls shall be similar to RCC slab. The thermal insulation shall be provided on West, North West and East side exposed walls, if specified.

## **17.0 ELECTRICAL INSTALLATION**

### **1.0 SCOPE**

- 1.1 The scope of this section covers electrical installation connected with the air conditioning work.

### **2.0 STANDARDS**

- 2.1 The following standards shall be applicable in addition to the relevant standards indicated in the sub-section.
- a) IS : 732 COP for electrical wiring installation
  - b) IS : 1646 COP for fire safety of buildings (General) electrical installation
  - c) IS : 5216 Guide for safety procedure & practice in electrical work
  - d) Indian Electricity Act and Rules

### **3.0 GENERAL REQUIREMENTS**

- 3.1 The electrical work pertaining to the air-conditioning installation shall be the responsibility of HVAC contractor unless otherwise indicated. The electrical work shall conform to the relevant Indian Standards and the codes and regulation of local authorities.

### **4.0 ELECTRICAL PANELS**

- 4.1 The panels shall be cubicle, flush front free standing with individual feeders housed in separate enclosure and shall conform to IS: 8623, IS: 3072, IS: 2147, IS: 4047, IS: 2516, IS: 2529, IS: 3914 and IS: 5124. The panel bus bars shall be of suitable size to withstand the short circuit conditions without failure. The ratings of feeders and accessories shall be selected for the full load current of the equipment or the feeder load. The indicating and measuring instruments shall be 144 x 144 square. All incoming and outgoing feeders shall be with phase indicating lamps and ammeters. The panel fabrication drawings shall be got approved before taking up the fabrication work. Refer Annexure A for technical specifications I general for the panel.

### **5.0 CABLING**

- 5.1 All cables shall be XLPE insulated, PVC sheathed and armoured cables with copper conductor upto 16 sq.mm and aluminium conductor of 25 sq.mm and above. The XLPE cables shall be in conformance with ISS:7098 Part 1, 1988, 1998. The cables and the laying shall conform to IS: 4288/IS: 1255 and other standards as applicable.

## 6.0 STARTERS

- 6.1 The starter selection shall be as indicated in the equipment data. The starters shall be totally enclosed air insulated metal clad conforming to IS : 5124, IS : 3914 and IS : 2959 and shall include adjustable thermal OL relays, single phase preventors, under voltage protection and additional contactors for inter-locking arrangement, indicators and remote controls.

## 7.0 EARTHING

- 7.1 All electrical equipments, panels, starters, cabling and conduiting shall be earthened conforming to IS: 732 and IS: 3043. The main earth grid shall be provided by others. The earthing conductors shall be as shown below:

Load	Earth conductor-GI	
Conduit & load upto 1 kw	2 nos.	10 SWG
2 to 10 kw	2 nos.	4 SWG
11 to 25 kw	2 nos.	12 x 2 mm
26 to 50 kw	2 nos.	20 x 3 mm
51 to 75 kw	2 nos.	25 x 3 mm
76 to 100 kw	2 nos.	20 x 6 mm
100 kw and above	2 nos.	25 x 6 mm

## 8.0 INSTALLATION & TESTING

- 8.1 The panels shall be provided with ISMC 75 base framework and grouted to the floor or the pedestal provided. Individual starters, control station etc. shall be provided with ISA 25 frame support and grouted properly. Cables and earthing shall be laid in rents indicated and shall be supported on cable trays and clamped. Cables and earthing laid on floor shall be through PVC pipe sleeves buried in the floor or in cable trench.
- 8.2 The electrical installation shall be tested as indicated is IS : 732 and IS : 3043. The IR valves of panels and cables and the earth resistance shall be measured and recorded. The test reports shall be signed and submitted by the licensed electrical supervisor.

## **18.0 EQUIPMENT DATA**

### 1.0 SCOPE

- 1.1 The scope under this section shall cover the basic data of equipments to be filled in by the tenderer for the equipment that he intends to supply from the approved makes.
- 1.2 The equipment data indicates the general and basic requirements. The equipment details especially the motor output etc. shall be as per the manufacturer.

### 2.0 STANDARDS & SPECIFICATIONS

- 2.1 The equipments shall conform to the relevant Indian Standard specification and shall be as specified under Technical specification.

3.0 GENERAL REQUIREMENTS

- 3.1 All equipments shall meet the details indicated in the equipment data and technical specification. The tenderer shall submit the detailed catalogues indicating technical details, physical dimensions, performance chart etc.
- 3.2 The equipments shall be new and free from defects and shall be supplied along with the manufacturer's test certificate, operation and maintenance manuals etc.

# Annexure A1

## Technical Specifications for Power Panel

The Auditorium HVAC electrical power distribution panel shall be in conformance with the specifications as laid down below. This is in addition to the relevant IS specifications.

The scope shall cover design, engineering, manufacture/fabrication, shop test, and supply of indoor type Electrical Power Distribution Panel board as described in this specification.

1. General specifications: The Power distribution panel shall be indoor and dead front type suitable for operation on 3 phase 4 wire 440Volts ( $\pm 10\%$ ), 50Hz AC system, neutral grounded at transformer end and panel shall be CPRI approved. The panel shall be compartmental type with insulated & appropriately rated / 400 Amps (TPN) tinned copper insulated bus bars supported on suitable insulators and separate cable and bus bar chambers. Panel shall be designed to withstand heaviest condition at site, with maximum expected ambient temperature of 45°C, 95% humidity, dusty weather.

2. The panel shall be comprising of the following.

2.1) Incomer : MCCB:125Amps, 25KA Four pole 415Volts, 50Hz, AC MCCB with thermal magnetic release, overload and short circuit protection, having ultimate breaking capacity  $I_{cu} = I_{cs}$  (service breaking capacity 100%) . Thermal adjustment: 0.8 to 1In, magnetic adjustment: 10 In Cage type terminals 70SQMM max for flex cable/95SQMM for rigid cable and as per Ref standard: IEC 60947-2.

MCCB should have following accessories: Spreaders, Extended ROM, Shunt coil, Aux and Trip alarm contacts, Protection: LI- adjustable overload and short circuit, ON/OFF auxiliary switch, Trip- fault signalling contacts, shunt release for remote trip.

Entry level Multifunction meter with 0.5 Accuracy and RS 485 port having Auxiliary supply: 44 volts to 300Volts AC/DC. Parameters to be measured: Volts, Amps, Frequency, p.f., KWatt, KVA, Wh, VAH, Run hours, On hours, and interrupts etc. CT: 150/5 Amps, RYB indicating lamps, ON/OFF/Trip lamps etc.

2.2) 6Amps SP MCB's:06 Nos

2.3) Outgoing feeders: 12Nos

2.4) 100Amps FP MCCB 16KA with O/L & SC):2 Nos  
(01 for Auditorium AHU & 01 No spare)

2.5) Feeder: 32Amps FP RCBO 300mAmps: 08 Nos

01 for Auditorium ODU 1

01 for Auditorium ODU 2

01 for Auditorium ODU 3

01 for Auditorium ODU 4

01 for Office AC

03 Nos spare

2.6) Feeder for Green room AC: 20Amps DP RCBO 300mAmps: 01 Nos & 01No spare.

- 3) The power distribution panel should be fabricated in conformance with the respective ISS (IS/IEC:60947-1, 2004 and IS:8623 (Part 1) 1993 and IE rules maintaining suitable phase to phase, phase to neutral and phase to earth, neutral to earth clearances. (Minimum clearance between Phases  $\geq 35\text{mm}$ , phase to earth, phase to neutral and neutral to earth shall be  $\geq 30\text{mm}$ ). All the components used in the panel should be ISI marked. Enough clearance shall be maintained in outgoing feeders from live terminals to the body / gland plates to facilitate for easy cable termination work. Enough height shall be maintained from gland plate to the incoming terminals (~400mm or as required) to accommodate the cable and for easy cable termination.

- 4) Short circuit withstand capacity: 36KA

- 5) Panel should be suitable to supply the air conditioner loads and shall be designed to withstand heaviest condition at site with max expected temperature rise of 45 deg. C above ambient.

- 6) Standards and codes: The Panel shall comply with the latest edition of the Indian

Standards Specification ISS:13947:1993 and Indian Electricity Rules and Regulations. Besides this the following Indian standards as applicable shall also be complied with:

ISS: 8623 (Part-1) 1993 for LV switchgear and control gear assembly.

ISS/IEC: 60947-1 2004 for LV switchgear and control gear.

IS13947 -1993 is the Specification for Low voltage switchgear and control gear

(Part I to Part V)

\*IS 4237 1982 General requirement for switch gear and control gear for voltage not exceeding 1000 volts. (superseded)

IS 2147-1962 Degree of protection provided by enclosures for low voltage switchgear and control gears.

IS 8828 1978 Miniature air circuit breakers.

IS : 5578 Guide for marking of insulated conductors.

IS : 11353 Guide for uniform system of marking and identification of conductors and apparatus Terminals.

IS : 8197 Terminal marking for electrical measuring instrument and their accessories.

IS : 2551 Danger notice plates

IS : 10118 Code of Practice for selection, installation and maintenance of switchgear and control-gear.

IS : 8623 Specification for factory built assemblies of switchgear and control gear for voltage upto and including 1000 V A.C. and 1200 V D.C.

IS : 8828 Miniature circuit breakers.

IS : 9224 HRC fuse links

IS : 2705 Current transformer

IS : 1248 Indicating instrument & IS : 722 Integrating instrument

7. Construction: The Panel shall be metal clad, totally enclosed, free standing rigid, floor / wall mounting type, air insulated, compartmentalized cubicle type with framed structure and bottom channel frame of suitable section. Its frame structure may be rolled / folded sheet section of 16/14 SWG CRCA sheet steel fabricated and powder coated of approved shed (Siemens Gray RAL 7032) indoor type. Doors and gland plate shall be 2.0mm thick and 3 mm thick respectively. Cable chambers shall be free from any live open connections.

Front doors of the panel shall be suitably hinged and lock-able . All doors shall be provided with concealed hinges, necessary earthing arrangement and shall be provided with bracings wherever required with easily openable door locks with common key.

The panel shall be so designed to provide sufficient space for cable alleys for incoming and outgoing cables. Removable gland plates shall be provided at bottom or as required. Compartment size shall be adequate for easy maintenance. All terminations and joints shall be easily accessible. The Panel manufacturer should have a design validated by CPRI / ERDA for breaking capacity of at least 50KA/ 100 KA for 1 Sec.

7.1) All CRCA sheet steel used in the construction of Panels shall be 2 mm. thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.

7.2) The indoor Panel shall be totally enclosed, completely dust and vermin proof, conforming to degree of protection IP-52.

7.3) Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasketed with neoprene rubber and shall be lockable.

7.4) All the covers of the panel shall be properly fitted and secured with the frame and holes in the panel be correctly positioned. Fixing screws shall enter into holes, taped into an adequate thickness of metal or provided with bolts and nuts. Self-threading screws shall not be used in the construction of Panels.

7.5) Adequate ventilation shall be provided by means of louvers....etc. to allow natural circulation of air. Ventilation louvers shall be suitably screened to prevent the entry of insects and foreign bodies.

Screen material shall be made of strong enough stainless steel. In addition to this the size of the Panels shall be designed in such a way that the internal space is sufficient for hot air movement and the electrical component does not attain temperature more than 45°C. All the electrical component shall be derated for 50°C.

7.6) Circuit compartments: Each feeder MCCB / MCB and incomer MCCB shall be housed in separate compartments and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with the MCCB in 'ON' position. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tiers in a vertical / horizontal section.

7.7) Instrument compartment: Separate adequate compartment shall be provided for accommodating instruments, indicating lamps and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the MCCB, bus-bar and connections.

7.8) Bus bars: The bus-bar shall be air insulated and made of high quality, high conductivity, high strength Copper . The bus-bar shall be of 3 phases and neutral system with separate neutral and earth bar. The interconnection between bus bars and various components shall be of high conductivity copper flexible wires. The bus-bar shall be of rectangular cross- section designed to withstand 250Amperes full load current for phase bus

bars and half rated current for neutral bus bars and shall have uniform cross-section throughout the length.

The bus bars and interconnections shall be insulated with heat shrinkable PVC sleeve and be colour coded in red, yellow, blue and black to identify the 3 phases and neutral of the system. The busbar shall be supported on unbreakable, non-hygroscopic SMC insulated supports at sufficiently close intervals to prevent bus bars sag and shall effectively withstand electromagnetic stresses in the event of fault level of 25KA.

The bus bar shall be housed in a separate compartment & the exposed sections be isolated with 3 mm thick Bakelite sheet to avoid any accidental contact. The bus bar shall be arranged such that minimum clearance between them shall be maintained as per ISS & IE rules and shall be as mentioned below:

Between phases	:	≥ 35 mm. minimum
Between phases and neutral	:	≥ 30 mm.
Between phases and earth	:	≥ 30 mm.
Between neutral and earth	:	≥ 30 mm. Minimum

All bus bar connections shall be done by drilling holes in bus bars and connecting by tinned plated brass bolts and nuts with plain and spring washers.

All connections between bus bars and MCB's / MCCB's and MCB/MCCB to cable terminals shall be through insulated cables of suitable / proper size to carry full rated current.

#### 8: Painting:

The fabricated panel should undergo a pre-treatment process like degreasing, pickling in acid, cold rinsing, phosphating, passivating through 7 tank process and then applying with high corrosion resistant primer and finally with two coats of Light grey RAL 7035 powder coating under vacuum and backing. The thickness of paint shall not be less than 80 microns.

#### 9. ELECTRICAL: POWER AND CONTROL WIRING CONNECTIONS:

- i. Terminals for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminium / copper conductor, XLPE insulated and PVC sheathed, armored cable and shall be suitable for connections of solderless sockets for the suitable cable size as specified.
- ii. Power connections for incoming & feeders of the panel shall be suitable for 1100 V grade aluminium conductor (LT XLPE) cables.
- iii. Power cabling shall be brought out in cable alley for ease of external connections, operation and maintenance.
- iv. Both control and power terminals shall be properly shrouded.
- v. 10% spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block, so that not more than one outgoing wire is connected per terminal. Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.
- vi. Wiring inside the panel for control and protection circuit and instruments etc. shall be done using 660 / 1100 V grade, PVC insulated copper conductor cables conforming to IS : 694 and IS : 8130. For current transformer circuits, 2.5 sq.mm copper conductor wires and for other control wiring / circuit 1.5 sq.mm copper conductor wires shall be used. All conductors shall be crimped with solderless sockets at the ends before connections are made to the terminals.
- vii. Appropriately rated HRC type control fuses or MCB's shall be provided in the control, metering and indicating lamps circuit.
- viii. Particular care shall be taken to ensure that the layout of wiring is neat and orderly. Identification ferrules shall be fitted to all the wire termination for ease of identification and to facilitate checking and testing.
- ix. Plain & spring type washers shall be used for all the control and power connections.
- x. Final wiring diagram of the Panel power and control circuit with ferrules numbers shall be submitted along with the Panel as one of the documents against the contract.
- xi. Input compartment shall have digital 3 phase 4 wire multifunction meter as specified with appropriately rated CT's for metering and protection.

**h) TERMINALS:**

The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments / metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables / wires to internal components of the distribution panel is permitted; only one conductor may be connected in one terminal.

**i) WIREWAYS:**

Horizontal PVC wire way with screwed covers shall be provided at the bottom/top to take interconnecting control wiring between different vertical sections.

**j) CABLE COMPARTMENTS:**

Cable compartment of adequate size shall be provided in the Distribution panel for easy clamping of all incoming and outgoing cables entering from the bottom. Adequate supports shall be provided in cable compartment to support cables. Minimum 200 mm gap should be provided in the Panel from Gland plate to feeder live terminal and 400mm gap between gland plate to incoming live terminal.

Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom. Adequate supports shall be provided in the cable compartments to support cables wherever required. All the incoming and outgoing terminals shall be brought out to terminal blocks in the cable compartment.

j1) Incoming compartment, cable chamber and bus bar arrangement shall be suitable for taking in the 2 numbers of 35SQMM, 3 and half core, Al, XLPE, Armored cables.

j2) Outgoing feeder and cable alley shall be suitable for taking in and terminating the multiple number of cables, feeder-wise as follows..

j2.1) 16/10sqmm 4 core copper conductor armoured cables- 10 Nos

j2.2) 35SQMM, 3 and half core, Al, XLPE, Armored cables- 02 Nos

**10..EARTHING:**

i. Earth bus of adequate size shall be provided in the panel for the entire length of the panel. The framework of the panel shall be connected to this earth bus. Provisions shall be made for connection from this earth bus on both sides of the panels to the main earthing bus coming from the earth pit. Door earthing shall be provided for all the compartments and the wires used for connections shall be flexible.

ii. The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar.

iii. Suitable arrangement for connecting outgoing earthing wires of 6/10sqmm size/ bare copper /GI wire may be made on earth bus bar or as feasible in the cable compartment.

**11..LABELS and markings:**

Engraved metal labels shall be provided on incoming and all outgoing feeders.

**12.NAME PLATE:**

i. A name plate with the Panel's designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.

ii. Inside the feeder compartments the electrical components, equipment, accessories like switchgear, control gear, lamps etc. shall suitably be identified by providing stickers.

iv. Name plate shall be fastened by counter sunk screws and not by adhesives.

**13. DANGER NOTICE PLATES:**

i. The danger notice plate shall be affixed in a permanent manner on operating side of the Panel and shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

ii. The danger notice plate, in general, shall meet the requirements of local inspecting authorities and should be of ISI certification mark.

iii. Overall dimensions of the danger notice plate may be of appropriate size to suit the panel door.

iv. The letters, the figures, the conventional skull and bones etc. shall be positioned on plate as per recommendation of IS: 2551-1982 and the said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS: 5-1978.

**14. INTERNAL COMPONENTS:**

i. The Panel shall be with MCCB & MCB's complete with all types of required number of, fuses, meter, instruments, indicating lamps, bus bars, cable , cable glands etc.

Components necessary for the proper and complete functioning of the panels but not mentioned in the specification shall be supplied and installed on the panel.

ii. All parts of the Panel including the current carrying, components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at the part of the Panel.

iii. All units of the same rating and specifications shall be fully interchangeable.

**i. MINIATURE CIRCUIT BREAKERS:**

Miniature Circuit breakers shall be current limiting type conformed with British standard BS: 3871 (Part I) 1965 and IS: 8825. The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 10 KA at 240 V. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical 'ON' and 'OFF' indications.

The circuit breaker dollies shall be of the trip free pattern to prevent closing the breaker on a faulty circuit.

The MCB contacts shall be silver nickel and silver graphite alloy and tip coated with silver.

All the MCBs shall be tested and certified as per Indian Standards, prior to installation.

**ii. MOULDED CASE CIRCUIT BREAKER:**

The moulded case circuit breaker (MCCB) shall be air break type and having quick make - quick break with trip free operating mechanism. Housing of the MCCB shall be of heat resistant and flame retardant insulating material. Operating handle of the MCCB shall be in front and clearly indicate ON/OFF/TRIP positions. The electrical contact of the circuit breaker shall be of high conducting non deteriorating silver alloy contacts. The MCCB shall be provided with thermal / magnetic type bi-metal overload release and electromagnetic short circuit protection device. All the releases shall operate on common trip bus-bar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided.

**iii. CURRENT TRANSFORMER:**

Where ammeters are called for C.T.s shall be provided for current measuring. Each phase shall be provided with separate current transformer of accuracy Class 0.5 and suitable VA burden for operation of associated metering. Current transformer shall be in accordance with IS: 2705 - 1964 as amended upto date.

**iv. INDICATING LAMPS:**

Indicating lamps shall be LED type and shall be supplied complete with translucent covers to diffuse the lamplight. Colour shade for the indicating lamps shall be--

- a) ON indicating lamp for incomer : Red,                      b) OFF indicating lamp : Green  
C) PHASE indicating lamp : Red, Yellow, and Blue

**v. Digital Multi Function Meter:**

The multifunction digital type meter with 0.5 accuracy class & RS485 port shall be provided on incomer compartment for 3 phase power measurement. It should measure KW, KVA, KVAR, KWH, KVAH, RKVAH, V, I, PF, F, Run hours / On hours etc.

**15. SHOP DRAWINGS:**

Prior to fabrication of the Panel the supplier / contractor shall submit the shop / vendor drawing consisting of G.A. drawing, sectional elevation, single line diagram, bill of material etc. and short circuit rating of all the electrical components used, bus-bar size, internal wiring size, Panel dimension, colour, mounting details etc. The contractor shall submit manufacturer's catalogues of the electrical components installed in the Panels.

**16. INSPECTION:**

At all reasonable times during production and prior to transport of the Panel to site, the supplier / contractor shall arrange and provide all the facilities at their plant for inspection of the panel by our representative.

**17. TEST CERTIFICATES:**

Testing of Panel shall be carried out at factory and at site as specified in Indian standards in the presence of electrical engineer. The test results shall be recorded on a prescribed form. The test certificate for the test carried out at factory and at site shall be submitted in duplicate.

**18. Documents:**

Vendor shall furnish drawings, data and manuals in 4 sets along with equipment supplied.

General arrangement drawing indicating accessories and dimensions.

Termination arrangement with dimensions, Three phase wiring diagrams,

Terminal plans & Bill of quantity for the panel.



**19. APPROVED MAKES OF MATERIALS for electrical panel**

<b>Sl.No.</b>	<b>Equipments</b>	<b>Makes</b>
1	MCCBs	Siemens / Schneider/Legrand
2	MCB	Schneider / Siemens / Legrand
3	CTs	AE/Kappa / Altran/Newtak or equivalent
4	Control Switches, rotary switches	L&T/ Kaycee / Salzer / Siemens / or equivalent
5	FRLS Wires for control and power circuit	Finolex / Polycab / Lapp
6	Digital Ammeter/ Voltmeter	Conzerv / Siemens/ /MECO/ AE/ L&T
7	Energy Meter (Multifunction digital type)	Conzerv/Siemens /HPL/L&T/schnieder
8	Terminal block	Elmex/Connect well/ Technoplast
9	Indicating lamp, LED type,	Siemens/Teknic/Control/ telemechanic
10	MCCB & MCB spreader links	Legrand / Schneider/ Siemens
11	CT shorting links isolating type	Connectwel /equivalent
12	Neutral links	Reputed make
13	Eye bolt, Hinges, locks with panel key	Standard/reputed make
14	Lables for panel	Standard
15	Sheet thickness	14/16SWG

# **Annexure B-1**

## **Technical Specifications- Indian Standard Specifications**

Generally all works under this contract shall be complied with the Indian Standards of latest version as stated earlier in this specifications. Following IS specifications may also be referred / complied with as per the requirement.

The contractor shall make available copies (upon Award of Contract) of the above standards for reference of the Owner.

### **AIR CONDITIONING EQUIPMENT:**

- IS 659 Safety Code for air conditioning
- IS 660 Safety Code for mechanical refrigeration
- IS 3615 Glossary of terms used in refrigeration & air conditioning
- IS 5111 Testing of refrigeration compressors
- IS 7896 Data for outside design conditions for air conditioning
- IS 10617 Thermostats for use in refrigeration, air conditioners etc.,
- IS 8148 Packaged air conditioners
- IS 10594 Thermostatic Expansion Valve SP 7 National Building Code (Group 4)

### **NOISE AND VIBRATION:**

- IS 2264 Preferred frequencies for acoustical measurements.
- IS 3483 Code of practice for noise reduction
- IS 3932 Sound level meter for general purpose use.
- IS 9736 Glossary of terms applicable to acoustics in buildings.
- IS 9901 Measurement of sound insulation in buildings & building element
- IS 9876 Guide to the measurement of air borne acoustical noise & evaluation of its effects on man
- IS 10423 Personal sound exposure meter
- IS 11446 Measurement of air borne noise emitted by compressors units intended for outdoor use.
- IS 12710 Glossary of terms used in acoustic emission testing.
- IS 4758 Methods of measurement of noise emitted by machines
- IS 14280 Mechanical vibration - balancing - shaft and fitment key convention
- IS 12065 Permissible limits of noise level for rotating electrical machines.

### **REFRIGERANT GAS AND OIL :**

- IS 4578 Lubricating oils for refrigerating machinery
- IS 10609 Refrigerants - Number - Designation

### **SHEET METAL WORKS:**

- IS 277 Galvanized Steel sheet
- IS 513 Cold rolled low carbon steel sheets.
- IS 655 Metal Air ducts

### **THERMAL INSULATION :**

- IS 3069 Glossary of terms, symbols & units relating to thermal insulation materials
- IS 3346 Method of determination of thermal conductivity of thermal insulation materials

### **VENTILATION : IS 3103 Code of practice for Industrial Ventilation**

- IS 4894 Centrifugal Fans

### **ELECTRICAL:**

- IS 325 Three phase induction motors
- IS 1822 Motor starters of voltage not exceeding 1000 V
- IS 996 Single phase small AC and universal motors
- IS 732 Code of practice for electrical wiring and fittings for buildings
- IS 2516 AC circuit breakers for voltage not exceeding 1000 volts

IS 4047 Heavy duty air break switches and composite units of air break switches and fuses not exceeding 1000 volts  
IS 2208 HRC cartridge fuse links up to 650 volts  
IS 1554-Part I PVC insulated (heavy duty) electric cables for working voltage up to and including 1100 volts.

#### SAFETY CODES:

IS 660 Safety code for mechanical refrigeration  
IS 659 Safety code for air conditioning  
IS 3016 Code of practice for fire precautions in welding and cutting operations  
IS 818 Code of practice for safety and health requirements in electrical and gas welding and cutting operations  
IS 5216 Code of safety procedures and practice in electrical works  
IS 3696 Safety codes for scaffolds and ladders.

#### INTERNATIONAL STANDARDS:

SMACNA HVAC Systems - Duct Design  
SMACNA HVAC Air duct leakage test manual  
SMACNA HVAC duct construction standards - Metal & flexible  
SMACNA Rectangular duct construction  
SMACNA Round duct construction  
SMACNA Energy conservation guidelines.  
SMACNA Energy recovery equipment and systems, air to air  
SMACNA HVAC Systems - Testing, adjusting & balancing  
ASHRAE / ISHRAE Handbooks  
ASHRAE Gravimetric & Dust spot procedures for testing air cleaning devices used in general ventilation for removing particulate matter. - 52.1  
ASHRAE Methods of testing liquid chilling packages.  
ASHRAE Number designation & safety classification of refrigerants  
ASHRAE Practices for measurement, testing & balancing of building, heating, ventilation & air conditioning system.  
ASHRAE Ventilation for acceptance indoor air quality-62.1-2007  
ASHRAE Commissioning of HVAC Systems.  
ASHRAE Methods of testing liquid chilling packages as per  
ASHRAE 30 Latest Standard  
ASHRAE Thermal environmental conditions for human occupancy-55  
ASHRAE Energy Standard for Buildings except Low-rise Residential Buildings -90.1  
UL-555 Fire Dampers  
ANSI Scheme for identification of piping system  
ARI Rotary Screw Chilling Package ARI 560 Latest  
AMCA Laboratory methods for testing fans for rating as per ANSI / AMCA 210

# Annexure C-1

## AIR HANDLING UNITS

Page 1 of 2

SR. NO	CRITERION	UNIT	DATA TO BE FILLED / FURNISHED BY VENDOR
1	Make		
2	Type		
3	Model		
4	Schematic & Dimensional Drawings	Attached	
5	AHU Size L x D x H	mm x mm x mm	
6	Operating Weight	kgs.	
7	Type of Vibration isolators		
8	Material of Construction of Components	Frame work / Casing	
9	Inner sheet casing thickness	mm	
10	Outer sheet casing	mm	
11	Thermal break	Provided/ Not Provided	
12	Insulation Material, Thickness & Density	PUF / mm / Kg/m <sup>3</sup>	
13	Drain pan material, gauge, insulation	/ G/ PUF	
14	Make of fan	Kruger	
15	Type of fan	Forward curved	
16	Size and Dia of Fans	mm	
17	No. of Fans / AHU	nos.	
18	Operating CFM & Range of CFM	CFM	
19	Fan Selection for Total Static Pressure	mm of .w.c.	
20	Fan RPM	RPM	
21	Fan Efficiency	%	
22	Fan Performance and Noise Curves	Attached	
23	AHU Outlet Velocity	FPM	
24	Type of Bearing		
25	Noise Level at 1Mtr from AHU	dBA	

















# Annexure C-1

## AIR HANDLING UNITS

Page 2 of 2

SR. NO	CRITERION	UNIT	DATA TO BE FILLED / FURNISHED BY VENDOR
26	Fan IKW	KW	
27	Recommended motor KW	KW	
28	Motor Make	SIEMENS/ABB	
29	Motor Type	TEFC / Sq.Cage	
30	Class of Insulation	F	
31	Electrical Characteristics		
32	Starting Current	amps	
33	Full Load Current (Amps)	amps	
34	Motor Speed RPM	rpm	
35	Method of Starting	DOL / Star-delta	
36	Starter manufacturer	L&T	
37	Water inlet / outlet temp to / from coil	Deg C	
38	Coil ADP	Deg C	
39	Coil capacity, TH	Btu/hr	
40	Coil capacity, SH	Btu/hr	
41	Coil capacity, LH	Btu/hr	
42	Coil Area, No. of Rows deep, Fin Spacing	Sq.Ft./ Nos / FPI	
43	Coil Face Velocity Air side	≤ 500 fpm	
44	Coil Flow Rate	USGPM	
45	Air pressure drop across coil	mm of w.c.	
46	Water pressure drop across coil	mm of w.c.	
47	Material of tubes / fins	Cu. / Al.	
48	Dia. of tubes / gauge of tubes		
49	Pre Filters Type, Face Areas	SQM	
50	Filters Ratings: Prefilter Efficiency	90% down to 10 microns	
51	Filter make		



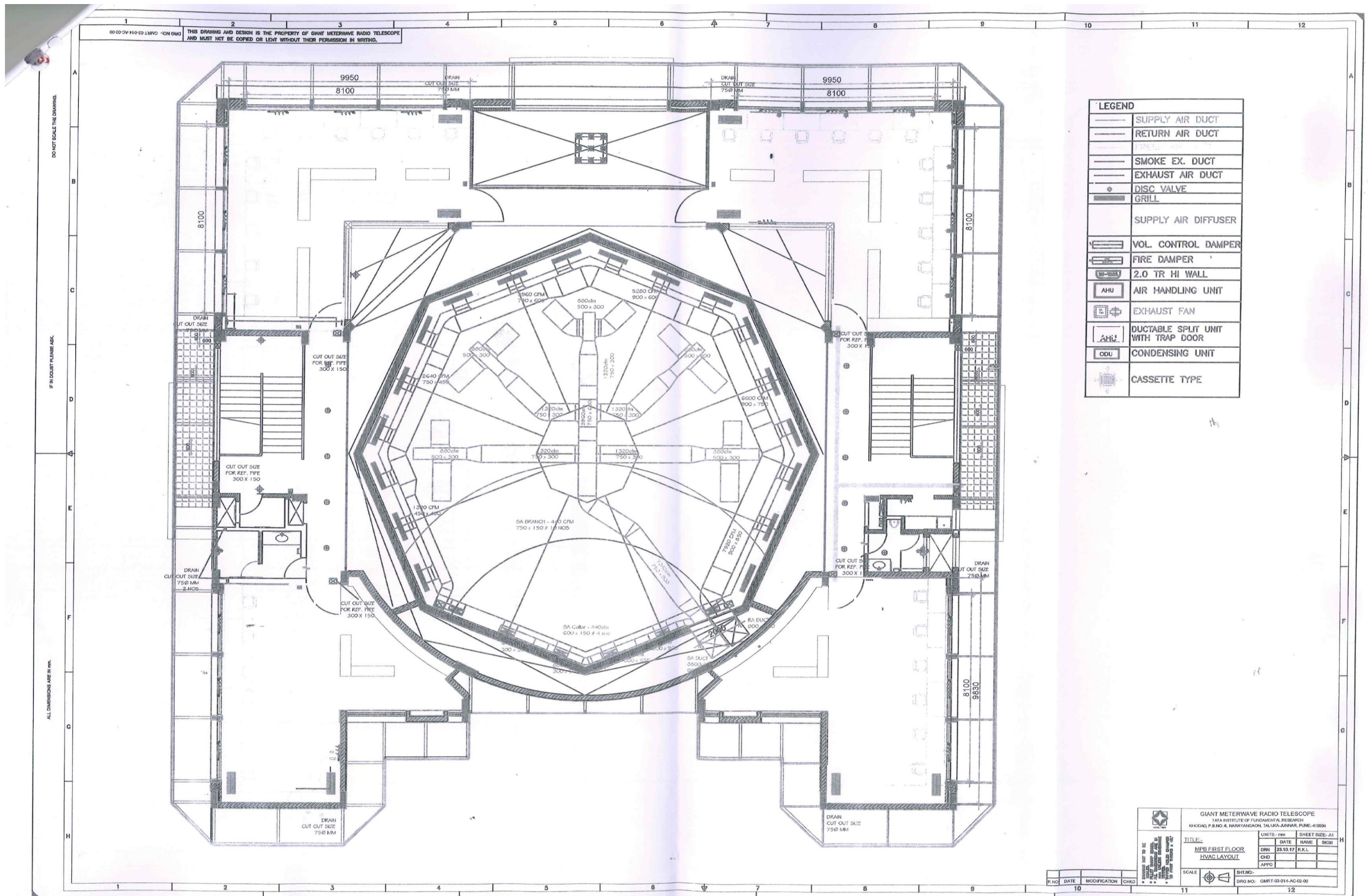
LEGEND	
	SUPPLY AIR DUCT
	RETURN AIR DUCT
	FRESH AIR INLET
	SMOKE EX. DUCT
	EXHAUST AIR DUCT
	DISC VALVE
	GRILL
	SUPPLY AIR DIFFUSER
	VOL. CONTROL DAMPER
	FIRE DAMPER
	2.0 TR HI WALL
	AIR HANDLING UNIT
	EXHAUST FAN
	DUCTABLE SPLIT UNIT WITH TRAP DOOR
	CONDENSING UNIT
	CASSETTE TYPE

4#NOS.  
5.5TR ODU  
150KG. EACH  
W1010 x D500 x H856

[illegible]

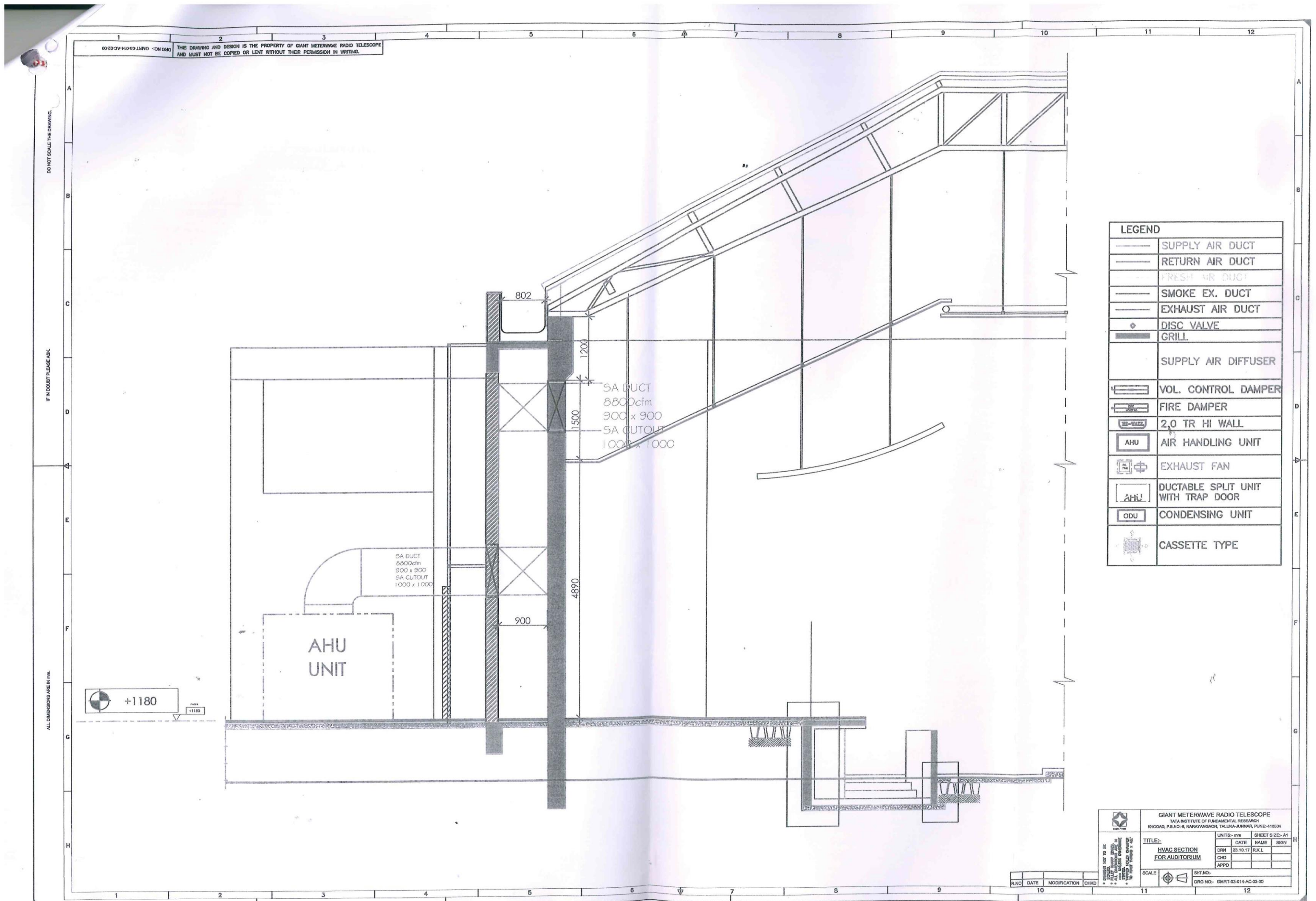


# Drawings 2 of 3





**Drawing 3 of 3**





## Chapter 5

Standard forms (To be enclosed by bidders with Part – I, Techno-commercial bid)

<b>Table of Contents</b>		
<b>Sl. No.</b>	<b>Contents</b>	<b>Page No.</b>
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2	Eligibility Criteria – Annexure –B	<b>107</b>
3	Manufacturers’ Authorization Form - Annexure – C	<b>108</b>
4	Format of Indemnity Bond* – Annexure – ‘D’	<b>109</b>
5	Schedule of Experience - Annexure – ‘E’	<b>110</b>
6	Schedule of Deviation from General Conditions - Annexure – ‘F’	<b>111</b>
7	Schedule of Deviation from Technical Conditions - Annexure – ‘G’	<b>112</b>
8	Bid Form - Annexure – ‘H’	<b>113</b>
9	Format of Bank Guarantee for Performance Bond*-Annexure – ‘I’	<b>114</b>
10	Format of Acceptance Certificates* - Annexure – ‘J’	<b>115</b>
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12	Bank Guarantee for Security Deposit* - Annexure – ‘L’	<b>117</b>
13	Bank Guarantee for handing over rejected item to Indian Manufacturer * - Annexure – ‘M’	<b>119</b>
14	Certificate of Site Visit Annexure - N	<b>121</b>
15	Format for furnishing Bank Details for refund of EMD/ making payment – Annexure-O enclosed	<b>122</b>
16	Undertaking that eligible similar works have not been executed by another contractor on back to back basis submitted as per Annexure -P .	<b>123</b>
17	Undertaking for having read and taken note of all the terms and conditions of the Tender as per Annexure- Q enclosed.	<b>124</b>

**\* To be used by vendor on whom order will be placed.**

## Annexure – “A”

### COMPANY PROFILE

(To be filled in by the Bidder)

Sl.No.	Question	Response
1.1	Company Name	
1.2	Type of firm Proprietary / Partnership / Pvt. Ltd. / Ltd. / Single Person Company	
1.3	Date of Incorporation	
1.4	Company Head Office address	
	* Contact person(s) Name	
	* Phone Number	
	* Fax Number	
	* E-mail Address	
1.5	Address of Pune office	
	* Contact person(s) Name	
	* Phone Number	
	* Fax Number	
	* E-mail Address	
1.6	Number of Employees	
	Marketing/Sales at Pune	
	Service Engineer at Pune	
1.7	State pending or past litigation if any within the last 3 years with details and explain reasons. Please also mention any claims/complaints received in the last three years.	
1.8	Date of Establishment of firm	

Signature of the Bidder

Name & Designation

Company Seal

Date:

## ANNEXURE -B

### ELIGIBILITY CRITERIA

Page 1 of 1

Sr.No.	Description	Details to be furnished by the contractor, enclosing relevant documents in the technical bid.
1	Bidder must visit the site to know exact scope of work, site conditions etc. and submit certificate of visit as per <b>Annexure -N</b> with their bid.	
2	Bidder must be an OEM or an authorized distributor / dealer / Partner of <b>Blue Star / LG/Voltas/Daiken/Carrier.</b> Manufacturer Authorisation Certificate as per our Format at <b>Annexure -C</b> , must be enclosed with the technical bid, if bid is from a Dealer / Distributor / Partner. <b>Bids for other makes will not be accepted.</b>	
3	Bidders can quote only for Single make.	
4	Bid must be valid for a minimum period of <b>180 days</b> from the due date for submission of bid.	
5	Bidder must have their service set up at Pune for the past <b>three years</b> from the date of this advertisement at Pune for undertaking sales and after sales service of the equipment.	
6	Bidders should submit along-with the quotations the proof of their Experience in carrying out the work of similar nature for supply and installation, testing and successfully commissioning of AC systems at Pune / Mumbai / Narayangaon.	

***NOTE : KINDLY FILL UP THE ABOVE DETAILS AND ENCLOSE ALONGWITH YOUR TECHNICAL BID – PART I, OTHERWISE YOUR BID WILL BE REJECTED.***

Signature of the Bidder

Name & Designation

Company Seal

Date:

**Annexure: “C”**

**MANUFACTURERS' AUTHORIZATION FORM**

*[The Bidder shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer.]*

Date:

Tender No.:

To:

WHEREAS We *[insert complete name of Manufacturer]*,.....who are official manufacturers of *[insert type of goods manufactured]*,.....having factories at *[insert full address of Manufacturer's factories]*, .....do hereby authorize *[insert complete name of Bidder]*.....to submit a bid the purpose of which is to provide the following Goods, manufactured by us *[insert name and or brief description of the Goods]*,.....and to subsequently negotiate and sign the Contract. We hereby extend our full guarantee and warranty, with respect to the Goods offered by the above firm.

Signed:

*[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name:

*[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Title:

*[insert title]*

Duly authorized to sign this Authorization on behalf of:

*[insert complete name of Bidder]*

Dated on \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_

*[insert date of signing]*

## ANNEXURE - D

### Format of Indemnity Bond

(if order is placed to be executed on **Rs. 500** Non-Judicial Stamp Paper by the contractor before commencement of work at site)

Work Order No. \_\_\_\_\_ Dt. \_\_\_\_\_

In consideration of National Centre for Radio Astrophysics, Tata Institute of Fundamental Research (NCRA/TIFR) having office at Pune University Campus, Ganeshkhind, Pune 411 007, hereinafter referred to as "The Institute", which expression shall unless it be repugnant to the context or meaning thereof, include its successors and assignors having awarded to M/s. \_\_\_\_\_ having registered office at \_\_\_\_\_, a firm carrying in such name and style the business of \_\_\_\_\_ (hereinafter referred to as "The Contractor" which expression shall unless it be repugnant to the context or meaning; thereof, include its partner(s) / proprietor(s) for the time being or its surviving partner(s) or its heirs and executors, administrators and assignees, its successors and assignors) the contract for \_\_\_\_\_ and in compliance with the terms and conditions of the said contract.

We M/s. \_\_\_\_\_ being the contractor shall save harmless and indemnify the Institute in respect of:

- a. Any expenses arising from any injury or accident or death of workers hired for this work or damage to property of any third party.
- b. Any claim made under any Act of Government or otherwise in respect of injury or damage as aforesaid.
- c. Any award of compensation or damages upon any claim as above.
- d. Any claim against the Institute by any member of the public or other third party in respect of anything, which may arise in respect of the works or in consequence thereof.
- e. Any claim which may be made upon the Institute whether under the Workman's Compensation Act or any other statute in force during the currency of this contract or of common law in respect of any worker of the contractor/or their family member(s) or of his sub-contractor(s).
- f. Any costs, charges or expenses arising out of any claim or proceeding and in respect of any award of compensation of damages arising therefrom.

For and on behalf of M/s. \_\_\_\_\_

Date:

S E A L

Accepted By

for and behalf of NCRA (TIFR) Pune

## **Annexure: E**

### **SCHEDULE OF EXPERIENCE SHOWING WORKS COMPLETED**

Customers (full Address)	Order No. and date	Work and location	Value of order (Rs.)	Date for completi on of work as per contract	Date of actual comple tion of work	Remarks indicating reasons for late delivery, if any	Has the equipment been installed Satisfactory? (Attach a copy of order and completion certificates from the purchaser)	Contact person Along with Telephone No., FAX No. and email address

Signature of the Bidder

Name & Designation

Company Seal

Date:

### **SCHEDULE OF EXPERIENCE SHOWING WORKS ON HAND**

Customers (full Address)	Order No. and date	Work and location	Value of order (Rs.)	Date for complet ion of work as per contract	Date of actual comple tion of work	Remarks indicating reasons for late delivery, if any	Has the equipment been installed Satisfactory? (Attach a copy of order and completion certificates from the purchaser)	Contact person Along with Telephone No., FAX No. and email address	% of work completed as on 31.05.2014

Signature of the Bidder

Name & Designation

Company Seal

Date:

**SCHEDULE OF DEVIATION FROM GENERAL CONDITIONS**

**1) The following are the particulars of deviations from the requirements of the tender specifications:**

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

Place:

Date:

Signature and seal of the  
Manufacturer/Bidder

NOTE:

1) Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “No Deviations”.

**Annexure: “G”**

**SCHEDULE OF DEVIATION (TECHNICAL ONLY)**

**1) The following are the particulars of deviations from the requirements of the tender specifications:**

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

Place:

Date:

Signature and seal of the  
Manufacturer/Bidder

NOTE:

1) Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “No Deviations”.



**BID FORM**

*[The Bidder shall fill in this Form in accordance with the instructions indicated No alterations to its format shall be permitted and no substitutions shall be accepted.]*

Date:

*[insert date (as day, month and year) of Bid Submission]*

Tender No.:

*[insert number from Tender Notice]*

To:

*[insert complete name of Purchaser]*

We, the undersigned, declare that:

(a) We have read & understand the bidding document and have no reservations,

(b) We offer to execute the order in conformity with the Bidding Documents and in accordance with the Delivery Schedules specified in the Schedule of Requirements the following Goods and Related Services *[insert a brief description of the Goods and Related Services]*;

(c) Our bid shall be valid for a period of **180 days**, from the date of opening techno commercial bid (Part– I), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) If our bid is accepted, we agree to submit security deposit and performance guarantee as per mentioned the tender document;

(e) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(f) We have seen the site and have understood the site conditions.

(g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Signed: *[insert signature of person whose name and capacity are shown]* In the capacity of *[insert legal capacity of person signing the Bid Submission Form]*

j) Name: *[insert complete name of person signing the Bid Submission Form]* Duly authorized to sign the bid for and on behalf of: *[insert complete name of Bidder]*

k) Dated on \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_ *[insert date of signing]*

**FORMAT OF BANK GUARANTEE FOR PERFORMANCE BOND**

**(On Non Judicial Stamp Paper of Appropriate Value)**

(To be obtained from any Nationalized Bank or Scheduled Bank by vendor on whom purchase order will be released)

To,  
Centre Director  
NCRA, Pune

WHEREAS ..... (Name and address of the supplier) (hereinafter called "the supplier") has undertaken, in pursuance of contract no. .... dated .....to supply (description of goods and services) (herein after called "the contract").

AND WHEREAS it has been stipulated by you in the said contract that the supplier shall furnish you with a bank guarantee by a scheduled commercial bank recognized by you for the sum specified therein as security for compliance with its obligations in accordance with the contract;

AND WHEREAS we have agreed to give the supplier such a bank guarantee;

NOW THEREFORE we hereby affirm that we are guarantors and responsible to you, on behalf of the supplier, up to a total of ..... (amount of the guarantee in words and figures), and we undertake to pay you, upon your first written demand declaring the supplier to be in default under the contract and without cavil or argument, any sum or sums within the limits of (amount of guarantee) as aforesaid, without your need to prove or to show grounds or reasons for your demand or the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the supplier before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the contract to be performed there under or of any of the contract documents which may be made between you and the supplier shall in any way release us from any liability under this guarantee and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until the ..... day of ....., 20.....

(Signature of the authorized officer of the Bank)

.....

Name and designation of the officer

.....

**Important information for future communication:** Seal, name & address of the Bank and address of the Branch alongwith the Telephone No., Fax No. and e-mail address of the bank manager.

**Note: Bank Guarantee without above details will be rejected.**

**FORMAT OF ACCEPTANCE CERTIFICATE**

**(To be issued by Purchasers Engineer to the successful Contactor on whom order is placed)**

No.

Dated:

M/s \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Sub: Certificate of commissioning of equipment

**1.** This is to certify that the equipment as detailed below has/have been received in good condition along with all the standard and special accessories (subject to remarks in **Para 2**).

**2.** The same has been installed and commissioned.

(a) Contract No. \_\_\_\_\_ Date \_\_\_\_\_

(b) Description of the equipment \_\_\_\_\_

(c) Name of the consignee \_\_\_\_\_

(d) Scheduled date of delivery of the equipment \_\_\_\_\_

(e) Actual date of receipt of equipment \_\_\_\_\_

(f) Scheduled date for completion of supply, testing and commissioning at site \_\_\_\_\_

(g) Actual date of completion of supply, testing and commissioning at site \_\_\_\_\_

(h) Liquidated Damages for delay in delivery Rs. \_\_\_\_\_

(i) Liquidated Damages for delay in commissioning Rs. \_\_\_\_\_

Details of accessories/items not yet supplied and recoveries to be made on that account:

Sl. No. Description Amount to be recovered

**3.** The acceptance test has been done to our entire satisfaction. The supplier has fulfilled his contractual obligations satisfactorily or

The supplier has failed to fulfill his contractual obligations with regard to the following:

(a).....

(b) .....

(c).....

(d).....

The amount of recovery on account of failure of the supplier to meet his contractual obligations is as indicated at **Sr. No. 2**.

For Supplier

Signature.....

Name.....

Designation.....

Name of the firm.....

Date.....

For Purchaser

Signature.....

Name.....

Designation.....

Name of the Lab./Instt.....

Date.....

**FORMAT OF DECLARATION REGARDING AMALGAMATION / ACQUISITION**

No. ----- Date:-----

1) **Amalgamation/Acquisition**

In the event of M/s. -----proposes for amalgamation, acquisition or sale of its business to any other firm during this contract period, M/s.----- and proposed Buyer/Successor of the Principal Company are liable to execute, fulfill contractual obligations without any deviations. For this purpose M/s. -----/M/s.----- and proposed Buyer/Successor of the Principal Company shall indemnify itself to the Centre Director, National Centre for Radio Astrophysics, TIFR, Pune to fulfill the contractual obligations as per the terms of NCRA Tender and bids of M/s. -----No. ----- dated-----and National Centre for Radio Astrophysics P.O. -----dated ----- . The contractual obligations are supply, installation, commissioning, configuration, warranty maintenance/replacement of spares, accessories etc. as per the above mentioned Purchase Order.

Company Seal & Phone No.:

Name & Signature of Bidder :

Designation :

Date :

**BANK GUARANTEE FORMAT FOR SECURITY DEPOSIT**

(To be submitted on appropriate value of Non Judicial stamp paper from any Nationalized Bank or  
HDFC/ICICI/Axis/IDBI Banks)

ORDER NO. \_\_\_\_\_ DTD. \_\_\_\_\_

To,  
Centre Director  
National Centre for Radio Astrophysics,  
Tata Institute of Fundamental Research,  
Pune University Campus, Ganeshkhind,  
Pune- 411 007, Maharashtra, INDIA.

This deed of guarantee executed on the \_\_\_\_\_ day of \_\_\_\_\_ by the  
\_\_\_\_\_ (bank) (hereinafter referred to as "the Bank: which expression shall wherever  
the context so requires or admits means and includes its successors and assigns).

WHEREAS M/s. \_\_\_\_\_  
having their registered office at \_\_\_\_\_  
\_\_\_\_\_ (hereinafter called "the Contractor") have conveyed to  
the Centre Director, NCRA/TIFR, Pune (hereinafter called "the Purchaser") acceptance of the Purchase Order / Work  
Order (whichever is applicable) No. \_\_\_\_\_ dtd. \_\_\_\_\_ for the \_\_\_\_\_  
\_\_\_\_\_ (hereinafter called the "Contractor").

In accordance with the terms as set out in the above quoted Purchase Order / Work Order, you have agreed to accept a  
bank guarantee for Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_  
\_\_\_\_\_ only) equivalent to \_\_\_\_\_ (percent) of the value of the contract in lieu of security deposit  
to be valid upto \_\_\_\_\_ or any extension that may be agreed to. For this purpose, you have agreed to  
accept our Guarantee.

In consideration thereof, we hereby (Bank), at the request of M/s. \_\_\_\_\_ irrecoverably  
and unconditionally undertake and guarantee to refund to the Centre Director, NCRA, TIFR, Pune on behalf of the said  
contractor a sum of Rs. \_\_\_\_\_ on demand and without any demure against any loss or damage that may  
be suffered by the Purchaser on receipt of your intimation that the M/s. \_\_\_\_\_  
\_\_\_\_\_ have for no reason failed to comply with any of the  
terms and conditions of the said contract, especially Item No. \_\_\_\_\_ of Annexure \_\_\_\_\_ to the Purchase  
Order regarding delivery schedule.

This guarantee shall be valid till (the date of completion of the work contained in the said order) as certified by you or  
till any extension of the date as may be agreed to by us. In the event, the guarantee shall expire 30 days after the said  
order is satisfactorily completed by you as conforming to the terms and conditions of the contract.

This guarantee shall not be revoked without your express consent and shall not be affected by you granting time or any  
other indulgence to M/s. \_\_\_\_\_ which shall include but not be limited to postponement  
from time to time if the exercise of any power vested in you or any right that you may have against to exercise the same  
in any manner at any time and either to enforce any covenant contained or implied in the said contract or any other  
course or remedy or security available to you and our bank shall not be released from its obligation under this bank  
guarantee by your exercising any of your rights with regard to matters aforesaid or any of them or by reason of any  
other act or forbearance or other act of omission or commission on your part or any other indulgence shown by you or  
any other matter or thing whatsoever which under law would but for this provision have the effect of relieving our bank  
from its obligation under this guarantee.

We shall agree that you shall be entitled at your option to enforce this guarantee against our bank as a principal debtor by a mere demand in writing from you which shall be conclusive evidence to us that such repayment is due and payable to you under the terms of the said contract and shall be binding on us notwithstanding any other security or guarantee that you may have in relation to M/s. \_\_\_\_\_ liabilities in respect of this premises.

This guarantee shall not be affected by any change in the constitution of our bank or of the companies or for any other reason whatsoever.

Notwithstanding anything herein contained our liability under this guarantee is restricted to \_\_\_\_\_ Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) and the guarantee will remain in force upto \_\_\_\_\_ or any extension that may be agreed to unless a demand or claim is filled against us on or before that said date of expiry viz. \_\_\_\_\_ all your rights under this guarantee shall be forfeited and we shall be relieved and discharged from all liabilities hereunder.

IN WITNESS WHEREOF the undersigned being duly authorized by the Directors of the Bank has hereunto set his hand at \_\_\_\_\_ this \_\_\_\_\_ day.

#### SIGNATURE OF BANK OFFICIAL

Bank Address :  
 Name :  
 Land Line No. :  
 Mobile No. :  
 Email address :  
 Rubber Stamp :

#### SIGNATURE OF WITNESS:

1.

2.

# **BANK GUARANTEE FOR HANDING OVER REJECTED ITEM FOR WHICH PAYMENT HAS ALREADY BEEN MADE**

**(On Non Judicial Stamp Paper of Appropriate Value)**

(To be obtained from any Nationalized Bank or Scheduled Bank by vendor on whom purchase order will be released)

The Center Director,  
National Centre for Radio Astrophysics,  
Tata Institute of Fundamental Research,  
Ganeshkhind, Pune – 411007.

Whereas on or about the \_\_\_\_\_ day of \_\_\_\_\_ 200 , M/s. \_\_\_\_\_ , a company having their office at \_\_\_\_\_ (hereinafter referred to as 'the vendor') entered into an agreement bearing No. \_\_\_\_\_ dt. \_\_\_\_\_ (hereinafter referred to as 'the contract') with the NCRA-TIFR, Pune (Hereinafter referred to as 'the purchaser') for supply \_\_\_\_\_ of (hereinafter referred to as the item') at a cost of \_\_\_\_\_ (in words).

Whereas as per the terms and conditions of the contract, the vendor had delivered to the purchaser all the item, out of which, \_\_\_\_\_ item costing \_\_\_\_\_ (in words) was found defective and not working satisfactorily after its receipt by the purchaser and therefore the item received from the vendor was rejected by the Purchaser.

Whereas as per the terms and conditions of the contract, the vendor has agreed to either repair or replace the Item, as is deemed fit, free of cost, to the purchaser within a period of \_\_\_\_\_ months from the date of receipt of the rejected item by the vendor, under the warranty conditions of the contract.

Whereas, as per the purchaser's policy, the vendor is required to furnish a Bank Guarantee for full value of the defective items amounting to \_\_\_\_\_ (in words) as a safeguard to the purchaser on account of any damage / loss that may be caused or suffered by the purchaser due to the vendor's inability/failure to return the item duly repaired or supply new items in replacement of the defective items within the specified time and also when the items lie under the vendor's custody, control or possession. Vendor has agreed to furnish the Bank Guarantee in this context.

Whereas the Vendor, based on the purchaser's requirement has agreed to furnish such a Bank Guarantee as a safeguard to the purchaser as indicated in para 4 above, valid till the return of the repaired item or replacement thereof, to the purchaser.

Whereas, we, \_\_\_\_\_ (the Bank), in consideration of the purchaser having agreed to despatch the defective items to M/s. \_\_\_\_\_ and vendor having agreed to repair/replace and return the defective items duly repaired or arrange free replacement of the defective item on FOR destination basis, do hereby agree and undertake to indemnify the purchaser and keep the purchaser indemnified to the extent of a sum not exceeding \_\_\_\_\_ (in words) against any loss or damage that may be caused or suffered by the purchaser by reason of the vendor either not returning the repaired items or arrange free replacement within a specified time and also when the items lie under the custody, control or possession of the vendor.

We, \_\_\_\_\_ (the Bank), do hereby undertake to pay to the Centre Director, NCRA-TIFR, Pune, the amount due and payable under this guarantee, without any demur, merely on a demand from the Centre Director, on behalf of the purchaser government, stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the purchaser by reason of the vendor either not returning the items duly repaired or arrange free replacement to the purchaser and also when the item lie under the custody, control or possession of vendor. Any such demand on the Bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. \_\_\_\_\_ (in words).

We undertake to pay to the purchaser any money so demanded notwithstanding any dispute or disputes raised by the vendor or by agents in any suit or proceeding pending before any court or tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the vendor and the Indian agents shall have no claim against us for making such payment.

And we, \_\_\_\_\_ (the Bank) hereby further agree that the decision of the said Center Director, NCRA-TIFR, Pune as to whether the vendor has committed breach of any such terms and conditions of the contract or not and as to the amount of damage or loss assessed by the said Center Director, NCRA-TIFR, Pune on account of such breach would be final and binding on us.

We, \_\_\_\_\_ (the Bank) further agree with the purchaser that the purchaser shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said agreement or to extend time for performance by the said vendor from time to time or to postpone for any time or from time to time, any of the powers exercisable by the purchaser against the said vendor/s and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said vendor/s or for any forbearance, act or commission on the part of the purchaser or any indulgence by the purchaser to the said vendor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

This guarantee will not be discharged due to the change in the constitution of the bank, the vendor or the agents.

Our guarantee shall remain in force until \_\_\_\_\_ and unless a claim under the guarantee is lodged with us within three months from that date, all rights of the purchaser under the guarantee shall be forfeited and we shall be relieved and discharged from all liabilities thereunder.

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20

**SIGNATURE OF BANK OFFICIAL**

Bank Address :  
 Name :  
 Land Line No. :  
 Mobile No. :  
 Email address :  
 Rubber Stamp :

**SIGNATURE OF WITNESS:**

- 1.
- 2.



**CERTIFICATE OF VISIT TO THE SITE**

Tender No.: \_\_\_\_\_ Date : \_\_\_\_\_

To,  
Centre Director,  
NCRA-TIFR,  
Pune 411007, India.

Dear Sir,

With reference to your tender mentioned above, we have visited the site and have understood the site conditions at Multipurpose Building, GMRT-NCRA, Khodad

**Multipurpose Building,  
Giant Metrewave Radio Telescope (GMRT) Office,  
Tata Institute of Fundamental Research (TIFR),  
At. Post. Khodad, Tal. Junnar,  
Dist. Pune 410504.**

where the tendered work is to be carried out.

Name & Signature of Bidder :

Name & Signature of Centre's Representative:

Designation :

Date :

Company Seal & Phone No .:

Date :

(Information to be submitted on Vendors Company Letter head)

Sub:- Bank Details for payment through Electronic Mode i.e. NEFT/RTGS

It is requested that settlement of all our bill/s from now onwards may please be made through Electronic Mode (NEFT/RTGS). The details of My/our bank account are as under :-

( Full Account Number to be furnished for making payment to be made through Electronic Mode)

6. MICR No. 

--	--	--	--	--	--	--	--	--	--

*Note: 1<sup>st</sup> three digit & last of 3 digit of MICR No. Should not be zero.*

8. Full Address of the Bank: .....

I hereby declare that the particulars given above are correct and complete. If the transaction is delayed or not effected at all for any reasons, We will not hold NCRA TIFR Pune responsible and agree to discharge the responsibility expected of us as a participant under the scheme.

Designation

Date \_\_\_\_\_

## **ANNEXURE-P**

**Page 1 of 1**

### **UNDERTAKING**

Undertaking that eligible similar works have not been executed by another contractor on back to back basis submitted.

Date : Signature of Bidder :

Name & Designation :

Place : Company Name & Address :

Company Seal & Phone No. :

**UNDERTAKING**

1. We have studied the complete tender document and accept all the terms and conditions.
2. It is certified that my firm/agency/company has never been black listed by any of the Departments / Autonomous Institutions / Universities / Public Sector Undertakings of the Government of India or Government of Maharashtra or any other State Government or Public Sector Banks or Local Bodies / Municipalities and no criminal case is pending against the said firm / agency as on  
\_\_\_\_\_.

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

**CHAPTER - 6**  
**UN-PRICED BID**

Page 1 of 1

<b>GST REGISTRATION NO.</b>	
<b>P&amp;F CHARGES</b>	
<b>FREIGHT AND INSURANCE CHARGES FOR DELIVERY OF ITEMS AT GMRT-NCRA, KHODAD.</b>	
<b>GST %.-</b>	
(A)Supply	
(B)Installation, Testing and Commissioning.	
<b>DELIVERY PERIOD</b>	_____ <b>Months</b>
<b>WARRANTY PERIOD</b>	_____ <b>YEAR /YEARS</b> _____ <b>YEARS</b>
<b>BID VALIDITY</b>	
Post Warranty Charges for Comprehensive AMC charges for 5 years Quoted	Yes / No
Post Warranty Charges for Non-Comprehensive AMC charges for 5 years Quoted	Yes / No

Date : Signature of Bidder :

Name & Designation :

Place : Company Name & Address :

Company Seal & Phone No. :

**PART - II****PRICE BID**

(To be submitted in a separate sealed Envelope)

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>A</b>	<b>EQUIPMENT:</b>			
<b>1.0</b>	<b>AIR HANDLING UNITS</b>			
<b>1.1</b>	<b>AHU For Auditorium</b>			
	Supply, Installation, Testing and Commissioning of Microprocessor based Sectionalised, Horizontal / Vertical Floor Mounted / Loft Mounted / Ceiling Suspended Double Skin Air Handling Units constructed of Extruded Aluminum hollow sections framework, Preplasticised GS Sheets of 24G (outside) / 22G (inside) with 43 mm thick injected PUF/40 kg/cu.m + 5% density with thermal break, consisting of Fan Section with belt driven DIDW Aerodynamic curved blower & TEFC motor, vibration isolators, Coil Section with 6 Row-12 FPI DX cooling coil suitable for DX Condensing unit configuration, insulated sandwich type drain tray of SS (inside) / GI (outside), damper at the outlet of AHU, 90% Efficiency 10 micron washable HDPE Pre-filters, Double canvass connections, access doors with limit switch, maintenance lamp inside the fan section, along with common base frame with adjustable rails, SS insulated base tray with liberal drain connections on either side, having multiple independent refrigerant circuits (5.5TR*4), CFC free refrigerant gas, complete with all accessories, all applicable standard safety cutouts such as HP/LP switch, O/L relay, single phasing preventer etc. complete as per Technical Specifications, AHU Summary Sheet and drawings.			
	Fan outlet velocity not to exceed 9 mps. Coil Face Velocity not to exceed 2.5 mps.			
	AHU Motors shall be of IE-3 Efficiency to meet Ashrae 90.1-2007 requirements.			
	AHU Panels shall be complete with acoustically lined with 25 mm thick acoustic insulation with Armasound foam having Thermal conductivity 0.045 W/m deg.K / density 140~180 kg/m3, with manufacturer recommended adhesive 520 bonding.			
a	22.0 TR / 8800 CFM at 65 mm TSP (6R / 12 FPI DX Coil) - Floor mounted, Horizontal Top Discharge AHU.	1	Nos.	
	Condensing Units - 5.5 TR # 4 nos (for each AHU Circuit).			
b	Thermostatic Expansion Valve suitable for AHU coil and Condensing unit combination with suitable distribution plate for above set of AHU & Condensing units.	1	Nos.	
<b>1.2</b>	<b>CONDENSING UNIT</b>			
	Supply, Installation, Testing & Commissioning of Air Cooled Condensing units with Scroll compressor, suitable for working with microprocessor based air handling unit, consisting of:			

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
	(i) Condensing unit with reputed make hermetically sealed Scroll compressor, air cooled condenser having copper tubing with extended aluminum fins and condenser fan with adequate air flow capacity suitable for operation at ambient temp. of 45 deg C.			
	(ii) Interconnecting refrigerant piping between evaporator & condensing units shall be laid as per site requirement including necessary clamping , supports , saddeling etc. The length of piping as required to be included. The suction lines shall be insulated with Armaflex or equivalent Nitrile rubber insulation.			
	(iii) Electrical panel, appropriately rated power wiring & control wiring for the condensing & evaporator units to be included along with end terminations. Power along with earthing would be provided near the Indoor Units, unless specified otherwise (Refer Srl. No 2 of annexure A for cables).			
	(iv) Supporting frames for condensing and evaporating units with vibration isolating pads. These shall be MS Powder coated.			
	(v) Necessary charge of oil and refrigerant gas as required for and upto handing over the system.			
	(vi) The units shall be suitable for operation on 415/440 Volts ( $\pm 10\%$ ) 3 ph., 50 Hz, 4 wire A.C. supply. 1 no separate outdoor duty MCB of appropriate ampere rating and breaking capacity and enclosure as per site requirement to break power (3 phase) is to be provided per cond. unit.			
1.2.1	Capacity – 5.5 TR.	4	nos	
<b>2.0</b>	<b>Starter &amp; Control Panel for AHU + Cond Units and Ductable Split AC Units</b>			
	Supply, Installation, Testing and Commissioning of Starter and control panel suitable for microprocessor based Air conditioning system working on 415 V, 3 phase, 50 Hz 4 wire power distribution system. The panel shall be with IP 54 protection and should be fabricated for wall mounting compartmentalised design as per specifications.			
	Starter & Control Panel comprising of incoming 4 pole MCB, Voltmeter, Ammeter, Phase indicating lamps etc. Outgoing feeders as DOL / StarDelta starter for AHU motor and MCB for each Condensing unit. Vendor to provide suitable capacity 2 nos spare feeders for AHU motor & Condensing units.			
	Starter and control panel shall be complete with necessary control, including OLP, SPP, ON/OFF push buttons with ON & OFF indications, 3 nos. non polarised NO-NC contacts for tripping of Fire Dampers and AHU motor on signal from Fire Alarm Panel. Also, vendor shall provide necessary interlocking for AHU & Condensing units operations including toggle switch for PSU & pumping down etc to be included as part of Starter and Control panel.			

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
	Vendor should consider power & control cabling from Starter panel upto respective AHU (Indoor unit) & each Condensing units (outdoor units).			
2.1	AHU 22 TR / 8800 CFM. Condensing Units - 5.5 TR # 4 nos (for each AHU)	1	Set	
<b>3.0</b>	<b>Refrigerant piping, Power / Control Cabling, Drain piping and MS stand</b>			
3.1	Additional Drain piping in hard PVC with all fittings, supports and clamps upto 50 mm dia. including drilling hole in wall chipping wall etc to conceal and to route drain pipe.	15	Rmt	
3.2	Set of Refrigerant Piping and Power & Control Cabling between Indoor & outdoor units complete for all circuits with Suction-line insulation and electrical cable & conduiting complete with supporting arrangement etc. for 5.5 TR machine as per OEM.	120	Rmt	
	<b>TOTAL OF [A] EQUIPMENT CARRIED OVER TO SUMMARY</b>			

Date : Signature of Bidder :

Name & Designation :

Place : Company Name & Address :

Company Seal & Phone No. :



SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>B</b>	<b>AIR DISTRIBUTION SYSTEM:</b>			
<b>1.0</b>	<b>GSS SHEET METAL DUCT:</b>			
	Supply, Fabrication, Installation and Testing of GSS metal ducts as per IS-277 for GS Sheets and IS-655 for fabrication of following thicknesses including necessary G.I. hangers / supports, volume control duct dampers, accessories, vanes, neoprene rubber gasket etc. complete as per specifications in accordance with the approved shop drawings. (Ducts to be sent in Prefabricated form at the jobsite. Site work will include assembly, installation and suit to site pieces and collars / droppers) The gasket used for smoke extract ducting shall be fire retardant.			
a)	24 gauge (0.63mm)	350	Sq.M	
b)	22 gauge (0.8mm)	150	Sq.M	
c)	20 gauge (1.0mm)	100	Sq.M	
d)	Use of scaffolding arrangement required for auditorium ducting installation including its transportation to site and back. Refer point 4 under 12 - air distribution system.	L.S.		
<b>2.0</b>	<b>FLEXIBLE CONNECTION:</b>			
	Supply, fabrication & installation of double canvass (fire retardant) flexible connection as per drawings & specifications. [only for Fans]	2	Sq.M	
<b>3.0</b>	<b>VOLUME CONTROL DAMPER:</b>			
	Supply, Installation and adjusting of GSS Volume Control Damper within ducts complete with suitable links, levers. Blades should be double skinned aerofoil construction and opposed blades should be at 50mm pitch centres. The blades should be mounted in nylon bushes operated by an interior wheel gear system. Manual quadrant control with position indicator to be provided to enable adjust volume of air as required.	3	Sq.M	
<b>4.0</b>	<b>FIRE AND SMOKE DAMPERS:</b>			
	Supply, Installation, Testing and Commissioning of Fire and Smoke Dampers (FSD) shall be installed in supply air and return air ducts when they pass through AHU room walls as shown in the drawings and as per specifications.			
	The Dampers shall be motor operated with atleast 120 minutes fire rating as per UL 555S-Class II for fire and smoke management rated for 120 min.as tested by CBRI Roorkee, India. Each FSD shall be of multi leaf type, low leakage and shall be tested in the factory and will be certified by the manufacturer in form of the test certificate.			
	Each FSD shall be supplied with matching sleeve (factory supply) and set of retaining angles for installation on wall / slab as indicated on drawings.			
	The fire and smoke damper FSD is to be installed in SA & RA for all Cinema AHU's & in SA for other AHU's.	4	Sq.M	

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>5.0</b>	<b>Motorised Actuator</b>			
	The Actuator shall be direct coupled spring return type and motorised.			
	The Actuator shall be in line with the Technical Specifications and shall be maintenance free direct coupled spring return type suitable to work on 24 V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open / close the damper. Shall have manual over ride facility. The selection of actuator size shall be the responsibility of the manufacturer. Power on indicating lamps with 230 V / 24 V transformer, damper close & open indication, reset push button, push button for manual running of actuator for periodic inspection, auxiliary contacts 24V & 230 V, contact points to receive signal from smoke detector / fire alarm panel etc. should be provided.	4	Nos.	
<b>6.0</b>	<b>GRILLS &amp; DIFFUSERS</b>			
	(All Grill and Diffuser Samples Shall be Approved by Engineer or Institutes representative prior to procurement)			
6.1	Supply / Return Air Ceiling Distributor			
	Distributor to have extruded aluminium outer core and a separate 4-way deflection fixed L bar central core. The central core should have a separate opposed blade volume control damper. Balance area should allow free flow of air through the outer cores. G.I Black painted plenum shall be mounted above the damper with a circular neck to accept insulated flexible duct. The finish to be powder coated-matt- black [out to out size - to match modular gridwork - 24" x 24"]			
	(The Ceiling Distributors shall be as per samples from approved vendors)			
a	Supply Air Diffuser size - 450 mm dia with Plenum	20	Nos.	
6.2	Supply / Return Air L-bar Continuous Grill			
	In extruded aluminium construction, powder coated. 150 one way/2 way fixed deflection with end flanges as required and as shown in the drawings.			
a	1200 x 150	24	nos	
6.3	Return Air L-bar Grill			
	In extruded aluminium powder coated construction with 4 side end flanges as required. The flanges to match the veneer provided in the false ceiling. (grills shorter than 1 mtr length are covered under this item)	2	Sq.M	
6.4	Aluminium Box type collar low leakage damper with special arrangement for volume control for above (Black Matt Powder Coated finish)	4	Sq.M	
6.5	Fresh Air Assembly To be mounted on the exposed wall / Facade glass frame . constructed in Extruded Aluminium Anodised finish. Blades inclined at 45° on 40mm pitch with Bird wire guard in galvanised steel with front flanged frame.			
6.5.1	For-Auditorium - Suitable for 1000 cfm	1	nos	

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>7.0</b>	<b>DUCT SOUND ATTENUATORS:</b>			
	Supply & Installation of Sound Attenuators -1500 mm long duct silencers at Cinema AHU Outlets as shown in the drawings. (For Audi's only.)			
a	SA Duct - 8800 cfm (approx. size 900 x 900)	2	Nos.	
b	Assorted size	1	sqm	
	<b>TOTAL OF [B] ANCILLARIES CARRIED OVER TO SUMMARY</b>			

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>C)</b>	<b>INSULATION:</b>			
<b>1</b>	<b>ACOUSTIC LINING (DUCTS):</b>			
	Supply, installation & testing of acoustic lining within supply and return air ducts as per specifications. All ducts shown cross hatched on the approved shop drawings shall be provided with acoustic lining of thermal insulation as per the specifications, 48 kg/cu.m. density with RP tissue and 24 G perforated Alum. Sheet as per Technical Specifications.			
1.1	25 mm thick acoustic lining for Auditorium	150	Sq.M	
1.2	12 mm thick acoustic lining for Labs & Office	50	Sq.M	
<b>2</b>	<b>THERMAL INSULATION</b>			
	Supply, installation & testing of external thermal insulation on ducts as per the specifications & approved shop drawings, 24 kg/sq.m. density with factory backed Alum. Foil of 0.09 mm thickness. Aluminium foil to be painted with black enamel paint.			
2.1	25 mm thick Fibreglass	250	Sq.M	
2.2	50 mm thick Fibreglass	200	Sq.M	
<b>3.0</b>	<b>ACOUSTIC INSULATION OF AIR HANDLING UNIT ROOMS:</b>			
	Supply, fabrication and installation of Acoustic insulation on walls and ceiling of AHU Rooms as specified and shown on the drawing complete with:			
	a) GI frame work 600 x 600			
	b) 48 kg/cum Rigid Board Fibreglass			
	c) 22 G Perforated Alum. cladding with 50mm overlap & GI channel			
3.1	50 mm thick acoustic insulation, in 2 layers each of 25 mm	120	Sq.M.	
<b>4.0</b>	<b>UNDERDECK INSULATION:</b>			BY OTHERS
	<b>TOTAL OF [C] INSULATION CARRIED OVER TO SUMMARY</b>	<b>Rs.</b>		

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

SR.NO	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)
<b>D)</b>	<b>HVAC Electrical panel:</b>			
1	Supply, installation, testing and commissioning of electrical power distribution panel shall cover design, engineering, manufacturing/fabrication, shop test and supply of indoor type Electrical power distribution panel with details as per Annexure A	1	Nos.	
	<b>TOTAL OF - [D] HVAC PANEL</b>	<b>Rs.</b>		
	Note: 1) Quantity variation: $\pm 15\%$ 2) Payments will be made on actual measured lengths. 3) Bidders should read the BOQ in conjunction with the tender technical specifications for quoting their rates.			
	<b>GRAND TOTAL - [A] + [B] + [C] + [D]</b>	<b>Rs.</b>		

Date : Signature of Bidder :

Name & Designation :

Place : Company Name & Address :

Company Seal & Phone No. :

## ANNEXURE A TO CHAPTER 6 – PRICE BID

## Bill of Quantity and rate for Auditorium HVAC Electrical Panel

Sr. No.	Description	Qty	Unit	Unit Rate Rs
1	Supply, installation, testing and commissioning of electrical power distribution panel shall cover design, engineering, manufacture/fabrication, shop test, and supply of indoor type Electrical Power Distribution Panel with details as given below and as per <b>Annexure A-1, Chapter 4 of Tech Specification/ Scope of Work.</b>	01	No	
1.1	Indoor floor /wall mounted cubicle, dead front type, Main power distribution panel, dust and vermin proof, fully tropicalized construction with 16/14 SWG MS sheet with necessary anti corrosive treatment and powder coating of approved quality and color. The panel shall be suitable for operation on 440Volts +/-10%, 3 phase, 4 wire, 50 Hz AC supply. The panel shall be compartmental type with insulated & 400 Amps (TPN) tinned copper insulated bus bars supported on suitable insulators and separate cable and bus bar chambers complete with all inter connections and consisting of :			
1.2	Incomer			
	Main incoming MCCB:125Amps, 25KA Four pole 415Volts, 50Hz, AC MCCB with thermal magnetic release, overload and short circuit protection, having ultimate breaking capacity Icu = Ics (service breaking capacity 100%) ..  <b>Qty:01 No</b>  The incoming panel which accommodates the MCCB shall be provided with indicating lamps for ON and OFF positions of the circuit breaker. Digital multifunction meter with CT of suitable range and accuracy Class I, KWH meter shall be provided as required for main incoming power supply. <b>Refer Annexure A-1, Chapter 4 of Technical Specification/ Scope of Work for details</b>			
1.3	Feeders			
1.3a	100Amps FP MCCB 16KA with O/L & SC) <b>Qty:02 Nos</b>			
1.3b	32Amps FP RCBO 300mAmps <b>Qty: 08 Nos</b>			
1.3c	20Amps DP RCBO 300mAmps <b>Qty:02 Nos</b>			

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

Sr. No.	Description	Qty	Unit	Unit Rate Rs
2	Incoming Power supply to the Electrical panel shall be provided by our Department. Further cabling from the Electrical panel to the AC equipment shall be provided by the AC supplier as follows. Distance between indoor to outdoor unit is approx.. 30 mtrs. each. HVAC panel to AHU may be 10 to 15 mtrs. (Rates for this may be considered under <b>A-1 Chapter 7 of Price Bid Sr. No. A-1.2.iii (Schedule of Quantity -HVAC)</b> )	Lot	Lot	
	Supply, Installation / laying, testing & Commissioning of appropriately rated electrical cables between main panel to indoor unit, indoor unit to outdoor unit, heaters etc., Cables shall be copper conductor power cables conforming to IS 7098 PT-1 with following specifications. Core color: Red, Yellow, Blue and Black Grade:1.1KV Stranded Copper conductor: XLPE insulated, Inner sheath of PVC taped, Overall FRLS Galvanized steel flat strip/round wire armored . (distance between indoor unit to outdoor unit shall be found out from the drawings OR the vendor should visit the site before quoting).			
3	Earthing to the main panel at both sides and from main panel to the AC's indoor unit, indoor unit to the outdoor unit / condenser (for all units) shall be provided with supply of 8 SWG copper earth conductor.	Lot	Lot	
4	<b>Notes for Electrical panel:</b>			
	i) Cleaning and surface treatment of panel frame and all steel parts of the panel shall be carried out through seven tank process. ii)After rigorous surface treatment, panel shall be treated with powder coating process. iii)Fire retardant paint shall be applied inside switch chambers and bus bar chambers. iv) Panel shall have fire retarding DMC/SMC (DMC -Dough Moulding Compound, SMC-Sheet Moulding Compound) filling for the opening around the bus bar near to the sectional barriers, and door inter locking facility for all compartments. v) All terminations shall be made with proper lugs in the approved manner. vi)All components, panel, cables etc., shall conform to the relevant IS specifications and shall also be got approved by EIC. vii) Erection, testing and commissioning of the system and various components shall be done as per the relevant IS specifications.			

**Quantity Variation +/- 15% of each item.**

Date	:	Signature of Bidder	:
		Name & Designation	:
Place	:	Company Name & Address	:
		Company Seal & Phone No.	:

<b>Post Warranty on site Annual Maintenance Charges for whole system</b>			
<b>Sl. No.</b>		<b>Comprehensive Rs.</b>	<b>Non-Comprehensive Rs.</b>
<b>1</b>	Post Warranty AMC charges for the First year		
<b>2</b>	Post Warranty AMC charges for the Second year		
<b>3</b>	Post Warranty AMC charges for the Third year		
<b>4</b>	Post Warranty AMC charges for the Fourth year		
<b>5</b>	Post Warranty AMC charges for the Fifth year		

GST Applicable	-----%
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Date : Signature of Bidder :  
 Name & Designation :  
 Place : Company Name & Address :  
 Company Seal & Phone No. :