PART – A (TECHNICAL BID)

TENDER DOCUMENTS

FOR

TENDER "Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001".

State Bank of India

TENDER ISSUED TO : _____(Not Applicable)_____
_____
_____
_____

TENDER COST : NIL

CLIENT : Assistant General Manager (P & E),
State Bank of India
Local Head Office – Delhi.
5th Floor, Block –D, 11 Parliament Street,
New Delhi – 110001.

ARCHITECT : M/S Taneja Associates Pvt. Ltd,
E-32, South Extension One
New Delhi - 110049
Phone no: 9811140520
Email: staneja@tanejaassociates.com

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Tender documents are in two parts (Volumes) i.e. Part – A and Part – B

PART – A (TECHNICAL BID)

NOTICE INVITING TENDER

State Bank of India invites online Tenders on item rate basis from the Bank's Empanelled Contractors Delhi Circle of **Electrical Work-Category i.e. from Rs. 15 Lakh to Rs. 25 Lakh & above** for **TENDER** for **Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001".**

Details of tenders are as under:

1.	Name of Work	:	**TENDER** for **Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001".**
2.	Time allowed for completion	:	**60 days** from date of handing over of the site.
3.	Earnest Money Deposit (EMD)	:	**Through ONLINE Mode e tendering portal of Antress systems ltd.** **i.e. Debit card / net banking / NEFT / RTGS** **Amount :₹24,300.00**
4.	Initial Security Deposit (ISD)	:	**EMD Shall be treated as ISD**
5.	Total Security Deposit	:	**5% of Total Contract Value**
6.	Pre- Bid Meeting	:	N/A
7.	Last date and time of Submission of Tenders	:	**23 .05.2025 at 2.30 p.m.**
8.	Address at which the Tenders are to be submitted	:	**Technical Bid : Scan copy of Duly Signed & Stamped UNDERTAKING (Annexure-A) to be submitted / uploaded online** www.tenderwizard.com **Hard copies (technical bid) to be submitted to :** **The Assistant General Manager (P&E); State Bank of India, LHO - Delhi, 5th Floor, Block – D, 11 Parliament Street New Delhi-110001.** **Price Bid : Duly filled Price Bid to be uploaded Online** www.tenderwizard.com
9.	Date and time of opening of Tenders	:	**23.05.2025 at 3.30 p.m.**

9.	Place of opening Tenders	:	**The Assistant General Manager (P&E); State Bank of India, LHO - Delhi, 5th Floor, Block – D, 11 Parliament Street New Delhi-110001.**
10.	Defects Liability Period	:	12 months from the date of handing over of the project to the satisfaction of Bank.
11.	Validity of Offer	:	90 days from the date of opening the Tenders.
12.	Liquidated Damages	:	At the rate of 0.5% of the Contract Value per week which subject to a maximum of 5% of the accepted Contract Value.
13.	Rates	:	This is an Item Rate Tender. Rates quoted by the bidder shall be including all labour, Materials, Royalities, Octori, taxes etc except GST which shall be paid extra at the rate & as per Govt / Statutory guidelines / Rules
14.	Note	:	If the vendor is found to have delayed the running/in hand project beyond the prescribed time limit specified in related tender document, the vendor will not be issued the new tender until completion of the previous delayed work.

15	Additional Performance Deposit (ASD) / Additional Performance Guarantee (APG)	:	• Additional Security deposit (ASD)/Additional performance Guarantee (APG) shall be applicable if the bid price is below 10% of the estimated cost put to tender. The amount of such ASD/ APG shall be the difference between 90% of estimated cost put to tender and the quoted price. ASD in the format of DD / Banker's Cheque / Bank Guarantee shall be submitted within 15 days of intimation of award of work / work order, without which the contractor will not be allowed to start the work and failure of submission of ASD will result in forfeiture of EMD and cancellation of tender. For e.g., if a contractor is quoting 15% below the estimated cost put to tender (i.e. 85% of the estimate), then ASD of 5% of estimated cost is required to be obtained from the contractor (90%-85%).

Mode of Submission of Tender:
Technical Bid (only Undertaking) and the Price Bid shall be submitted online only. First the Technical Bids (Undertaking) shall be opened and after that the Price Bids of only those bidders shall be opened who have submitted / uploaded the Technical Bid (Undertaking) and Requisite EMD.
In case the date of opening of tenders is declared as a holiday, the tenders will be opened on the next working day at the same time.

State Bank Academy has the right to accept / reject any or all tenders without assigning any reasons.

For E-Tender related queries:
Service provider: M/s Antares Systems Limited, Registered Office at: - #24, Sudha Complex, 3rd Stage, 4th Block, Bangalore – 560079. Ph: - 080-49352000 / 40482000 Fax: - 080-49352034

Help Desk: Contact Person: Mr. Pushpraj / Mr. TousikGhosh / Mr. Kushal Bose Mobile no. 7503347659 / 09674758724 / 07686913157 (On working days-9 hours–18 hours)

E-mail: pushpraj@antaressystems.com/ tousik.g@antaressystems.com / kushal.b@antaressystems.com

For any other queries the vendors may contact to the Architects and / or Bank Officials at

Regional Business Office and / or Branch Manager and /or Assistant General Manager (Civil), State Bank Acedemy,Plot No.77, Sector 18, Delhi , Haryana

The Assistant General Manager (P&E);
State Bank of India, LHO - Delhi,
5th Floor, Block – D, 11 Parliament Street
New Delhi-110001.

Annexure-A

UNDERTAKING

(Scan Copy to be uploaded after duly signing and putting seal / stamp of the Firm)

To,

The Assistant General Manager (P&E);
State Bank of India, LHO - Delhi,
5th Floor, Block – D, 11 Parliament Street
New Delhi-110001.

Dear Sir,

Subject TENDER for Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001".

1. I / We refer to the tender notice (NIT) issued by you for, HVAC works in connection with the above.

2. **I undertake to submit in Hard copy the tender document along with all terms & Conditions, Specifications and subsequent annexure and Corrigendum's duly signed and stamped by authorized representative/ signatory on becoming L1. However we accept all the terms and conditions along with the specifications, Drawings, Layouts etc defined in the tender documents uploaded at site.**

3. I/ We hereby offer to perform, provide, execute, complete and maintain the works in conformity with the drawings, designs, conditions of contracts, specifications, schedule of quantities relating to the works.

4. I/ We have satisfied myself/ ourselves as to the site conditions, examined the drawings and all aspects of the tender conditions, subject to above, I/ We do hereby agree, should this tender be accepted in whole or in part, to:

a. Abide by and fullfill all the terms and provisions of the said conditions annexed here to,

b. Complete the works within **the period as mentioned in NIT** as per the work program in two or three shifts if considered necessary by the Employer / Consultants at no extra cost to the Employer.

5. I / We have deposited an **earnest money as per NIT** which will not bear any interest and is liable for forfeiture and I may not be allowed to participate in any of the tender of SBI for a period of 06 months from the date of opening of this tender

   I. If the offer/Bid is withdrawn by us within the validity period of acceptance.

   Or

   II. If the contract agreement is not executed by us within 7 days from the date of receipt

of the letter of acceptance.

Or

III. If we fail to pay the initial security deposit/ASD/APG as stipulated.

Or

IV. If the work is not commenced within 7 days from the date of issue of letter of Acceptance by the architect/Bank.

6. I / We understand that the Bank is not bound to accept the lowest or any tender.

(Signature of Authorized Person of the Firm) (Seal of the Firm)

Name of the Signatory :

Date :

Place :

FORM OF TENDER

To,
The Assistant General Manager (P&E);
State Bank of India, LHO - Delhi,
5th Floor, Block – D, 11 Parliament Street
New Delhi-110001.

Dear Sir,

HVAC work: **TENDER for Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001".**

I/ We refer to the Notice Inviting Tender issued by you for the captioned work.

1. I/ We do hereby offer to perform, provide, execute, complete and maintain the works in conformity with Bill of Quantities, Drawings, Specification, Design, General and Special conditions of Contract, Instruction to tenderers, etc. as contained in the tender documents for the sum as arrived and filled, at the respective rates quoted by me/us in the Schedule of Quantities and/or at any other sum and rate subsequently negotiated and accepted / agreed by the Bank and me/us.

2. I/We have satisfied myself / our self as to the site conditions, examined site and drawings, and all aspects of tender documents / conditions and are acceptable to us. I/We do hereby agree, should this tender be accepted in whole or in part, to,

(A) Abide by and full-fill the terms, conditions and provisions of tender documents annexed hereto.

(B) Complete the work within stipulated completion time at no extra cost to the Bank.

3. I/We have already deposited the Earnest Money Amount as per NIT.

4. I/We are uploading /submitting the Part-A (Technical Bid) and Part-B (Price Bid) with other repuisite documents online at designated site.

5. I/WeconfirmthatI/Wearedulyauthorizedtoparticipateinthetendering/bidding and understand that my / our tender is liable to be rejected if,

   (i) At any times it comes to the notice of the Banks that I/We have concealed or / and have given any wrong information.

   (ii) The tender is not duly filed and /or signed and / or is incomplete and/or not kept confidential.

   (iii) The bid contains any condition / alteration / modification and/or any

tempering with the tender documents is done at our end.

(iv) Tender submitted after due date and time All the pages of the tender documents are affixed with the seal/stamp of my/our company and initialed / signed by the undersigned.

Signature of Tenderer/s

Seal /stamp of the firm/company
(Duly authorized for tendering)

(On Non -Judicial Stamp paper of appropriate value)

ARTICLES OF AGREEMENT

This agreement made on the _____day of _____Two Thousand _____ BETWEEN State Bank of India a corporation constructed under the State Bank of India Act, 1955 and having its Local Head Office at New Delhi and many other places, (hereinafter called "the Employer") of the one part and M/s _____through its _____ having its registered office at _____ (hereinafter called "the Contractor") of the other part.

WHEREAS the Employer is desirous of executing **TENDER** for **Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001"** to be carried out as per Schedule-I, to this agreement and has caused Drawings, Bills of Quantities and Specification describing the work to be done, prepared by **M/S Taneja Associates Pvt. Ltd, E-32, South Extension One, New Delhi - 110049** (Here in after called "The Consultant/ The Architect").

AND WHEREAS the said Drawings, the Bills of Quantities marked pages _____to ____(inclusive) and the Specifications as stated have been signed by or on behalf of the parties hereto:

AND WHEREAS the Contractor has agreed to execute the work upon the Conditions of Tender and the Conditions of Contract and further subject to the Special Conditions set forth in Schedule-II hereto attached (hereinafter collectively referred to as "the said Conditions") as per the said Drawings and as described in the said Specification and included in the said Bills of Quantities for the sum of Rupees _____

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the sum of Rupees _____ to be paid at the time and in the manner set forth in the said Conditions, the Contractor shall upon and subject to the said Drawings and described in the said Specification and Bills of Quantities.
2. The Employer shall pay to the Contractor the said sum of Rs. _____

_____or such other sum as shall become payable hereunder at the times and in the manner specified hereinafter.

3. The term "The Consultant / The Architect" in the said conditions shall mean **M/S Taneja Associates Pvt. Ltd, E-32, South Extension One, New Delhi – 110049**or in the event of their ceasing to be Consultants for the purposes of this Contract, such other persons as shall be nominated for that purpose by the Employer, not being a person to whom the contractor shall object for reasons considered to be sufficient by the Employer mentioned in the said Conditions. Provided always that no persons subsequently appointed to be Consultants under this Contract shall be entitled to disregard or overrule any decision or approval or direction given or expressed by the Consultants for the time being.

4. The said Conditions, Specifications and Priced Bills of Quantities shall be read and construed as forming part of this agreement, and the parties hereto shall respectively abide by and submit themselves to the conditions and stipulations and perform the agreement on their parts respectively in such Conditions, Specifications and Priced Bills of Quantities contained.

5. This agreement is subject to jurisdiction of courts in Delhi only.

6. **The Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;,** shall exercise powers on behalf of the said Employer for the purpose of the Contract Agreement.

7. Whereas both the parties agree to sign the following annexure Annexed to this Agreement in token of their acceptance.

   i) Agreement
   ii) NIT , Instructions &General Conditions of contract
   iii) Special& Additional Condition of Contract.
   iv) Safety Codes
   v) Specifications.
   vi) Material Testing & Their Frequency
   vii) List of Approved Makes / Brands
   viii) Priced Bill of Quantities.
   ix) Drawings.

8. The Bank shall pay the contractor such sum as shall become payable hereunder at the times and in the manner specified in the said Conditions mentioned in the General Conditions of Contract.

9. Whereas the Contractor hereby undertakes and agrees to carry out and complete the works within **60 days** from the date of handing over site or 7

days from the date of issue of letter of acceptances, whichever is later. The Contractor agrees and has deposited the sum of Rs. ____NIL____by way of Initial Security Deposit for due fulfillment of this Contract for the Works. It is agreed that the Security Deposit shall be deducted from each running bills and refunded to the contractor as per clause 2 of the General Conditions of the Contract Annexed herewith.

10. Whereas it is agreed that the earnest money as per NIT deposited by the Contractor in the form of Demand Draft along with the tender shall be forfeited in full in case the Contractor does not remit the Initial Security Deposit/ASD/APG within the stipulated period and/or fail to the start of the works by the stipulated date mentioned in the letter of Acceptance.

11. Whereas Shri _____is the accredited representative(s) of the Contractor who would be responsible for taking instructions from the Employer in relation to the Works. The Contractor agrees to pay Sales Tax or any other Tax on material or finished works like Works Contract Tax, Turnover Tax etc. including Income Tax in respect of this Contract of the Works and the Employer will not entertain any claim whatsoever in this regard nor the Employer shall be responsible to pay any Tax as mentioned above. If due to non – payment of any of the aforesaid Tax or other Taxes connected with the Works, the Contractor suffers any loss or damages occurred to the Contractor and the Employer will be entitled to claim damages from the contractor for non completion of the Work within **12 calendar months** stipulated in Para 9, above.

12. Whereas the Contractor hereby declares the list of all the relative working with the Employer which is annexed herewith.

OR

Whereas the Contractor declares that none of his relative is working with the Employer.

OR

Whereas the Contractor declares that he has associated himself with the agencies of the appropriate classes of person for Sanitary and Water Supply Installation etc. or any other specialized job to complete the works.

The Plans, Drawings, Specifications, Contract Documents and the Documents above mentioned shall form basis of this Contract and the decision of **The Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;** for the time being as mentioned in the Conditions of Contract in reference to all matters of dispute as to material, workmanship or account and as to the intended interpretation of the clauses of the Agreement or any of the document attached hereto shall be final and binding on both parties and may be made rule of the court.

The work comprises of the **TENDER for Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New**

Delhi - 110001".

13. as mentioned above and all subsidiary and other works connected therewith on the same site as may be ordered to be done from time to time by **The Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;**. For the time being even though such works may not have been shown on the Plans or described in the said Specifications or Schedule of Quantities of various classes of Work to be done.

14. The Employer through the **Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;** reserves himself the right of altering the Plans, Drawings and nature of Work of adding to or omitting any items of work or having portions of the same carried out departmentally or otherwise and such alterations or variations shall be carried out without prejudice to this Contract.

15. All disputes arising out of or in any way connected with this agreement shall be deemed to have arisen in Delhi and only the courts of Delhi shall have jurisdiction to determine the same.

16. The several parts of this Contract have been read to us and fully understood by us.In Witness whereof the parties above named have executed these presents today and year first hereinabove written.

Signed, Sealed and Delivered by:

Authorized Representative of SBI Authorized

Representative of Contractor Authorized

Representative of the Bank

SCHEDULE I

TENDER for **Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001"** all as described in Tender and Drawings inclusive hereto as Specifications.

SCHEDULE II

The following Letters / Correspondence form a part of Agreement:

1.

2.

3.

As witness our hands the day and year first written above,

In presence of

Signature:
Name:
Occupation:
Address:

Signature by the said Employer
Name:
Designation:
Address:

In presence of

Signature:
Name:
Occupation:
Address:

Signature by the said Contractor
Name:
Designation:
Address:

INSTRUCTIONS TO THE TENDERERS

1.0 Scope of Work

TENDER for **Renovation of HVAC works for State Bank of India, local Head Office at 3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001"** all as described in Tender and Drawings inclusive hereto as Specifications.

1.1 **Site and its location**:
The proposed work is to be carried out at **3rd Floor, D Block, 11 Parliament Street, New Delhi - 110001"**

2.0 Tender Documents

2.1 The work has to be carried out strictly according to the condition stipulated in the tender consisting the following documents and the most workmen like manner.

Instructions to tenderers
General Conditions of Contract
Special Condition of Contract
Additional conditions
Technical Specifications
Drawings
Price Bid
NIT
Performance Guarantee Agreement

2.2 The above documents shall be taken as complementary and mutually explanatory of one another but in case of ambiguities or discrepancies, shall take precedence in the order given below:

(a) Price bid
(b) NIT, corrigenda and addenda
(c) Additional Conditions
(d) Technical Specifications
(e) Drawings
(f) Special Condition of Contract
(g) General Condition of Contract
(h) Instructions to Tenderers

2.3 Complete set of tender documents including relative drawings can be downloaded from e-Tendering portal of e-Tendering service provider engaged by SBI

2.4 The tender documents are not transferable.

3.0 Site Visit

The tenderer must obtain himself on his own responsibility and his own expenses all information and data which may be required for the purpose of filling this tender document and enter into a contract for the satisfactory performance of the work. The tenderer is requested to satisfy himself regarding the availability of water, power, transport and communication facilities, the character quality and quantity of the materials, labor, the law and order situations, climatic conditions, local authorities requirement, traffic regulations etc; The tenderer will be fully responsible for considering the financial effect of any or all the factors while submitting his tender.

4.0 Earnest Money

4.1 The tenderer are requested to submit the Earnest Money as mentioned in NIT

4.2 EMD in any other form other than as specified above will not be accepted. Tender not accompanied by the EMD in accordance with clause 4.1 above shall be rejected.

4.3 No interest will be paid on the EMD

4.4 EMD of unsuccessful tenderer will be refunded within 30 days of award of contract.

4.5 EMD of successful tenderer will be retained as a part of security deposit.

5.0 Initial Security Deposit(ISD)

The successful tenderer will have to submit a sum as mentioned in NIT within a period of 15 days of acceptance of tender.

6.0 Security Deposit(TSD)

6.1 Total Security Deposit shall be as per NIT which is including ISD. Balance difference of TSD & ISD shall be deducted from the running bill of the work at the rate of 10% of the respective running account bill i.e. deduction from each running bill account will be 10% till total 5% of contract value is reached. 50% of the total security shall be paid to the contractors on the basis of architect's certifying the virtual completion. The Balance 50% would be paid to the contractors after successful completion defects liability period as specified in the contract.

6.2 No interest shall be paid on the amount retained by the Bank as Security Deposit.

7.0 Signing of contract documents

The successful tenderer shall be bound to implement the contract by signing agreement and conditions of contract attached herewith within 30 days from the receipt of intimation of acceptance of his tender by the Bank. However, the written acceptance of the tender by the Bank will constitute a binding agreement between the Bank and successful tenderer whether such formal agreement is subsequently entered into or not.

8.0 Completion period

Time is essence of the contract. The work should be completed in all respects in accordance with the terms of contract within a period as specified in the NIT from the date of handing over of site or from the date of Letter of Acceptance whichever is later.

9.0 Validity of tender

Tenders shall remain valid and open for acceptance for a period as mentioned in the NIT (validity of Offer) from the date of opening of price bid. If the tenderer withdraws his/ her offer during the validity period or makes modifications in his/her original offer which are not acceptable to the Bank, without prejudice to any other right or remedy, the Bank shall be at liberty to forfeit the EMD.

10.0 Liquidated Damages

The liquidated damages shall be as mentioned in the NIT.

11.0 Rate and prices:

11.1 In case of item rate tender

11.1.1 The tenderers shall quote their rates for individual items both in words and figures. In case of discrepancy between the rate quoted in words and figures the unit rate quoted in words will prevail. If no rate is quoted for a particular item the contractor shall not be paid for that item when it is executed.

The amount of each item shall be calculated and the requisite total is given. In case of discrepancy between the unit rate and total amount calculated from multiplication of unit rate and the quantity, the unit rate quoted will govern and the amount will be corrected.

11.1.2 The tenderers need not quote their rates for which no quantities have been given. In case the tenderer quote their rates for such items those will be ignored and will not be considered during execution.

11.1.3 The tenderers should not change the units as specified in the tender. If any

unit is changed the tenders would be evaluated as per the original unit and the contractor would be paid accordingly.

The tenderers should not change or modify or delete the description of the item. If any discrepancy is observed he should immediately bring to the knowledge of the Architect/ Bank.

11.1.4 Each page of the BOQ shall be signed by the authorized person and cutting or overwriting shall be duly attested by him

11.1.5 Each page shall be totaled and the grand total shall be given.

11.1.6 The rate quoted shall be firm and shall include all costs, allowances, taxes, levies etc. unless otherwise specified to be paid extra in these tender documents

GENERAL CONDITIONS OF CONTRACT

1.0 Definitions:

"Contract" means the documents forming the tender and the acceptance thereof and the formal agreement executed between State Bank of India (client) and the Contractor, together with the documents referred therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Architects/ Bank and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.

1.1 In the contract the following expressions shall, unless the context otherwise requires, have the meaning hereby respectively assigned to them.

1.1.1 'SBI' shall mean State Bank of India (client) a body corporate created under State Bank of India Act 1955, having its Corporate Centre at State Bank Bhavan, Madame Cama Road, Mumbai-400 021 and LHO at Delhi, and includes the Client's representatives, successors and assigns.

'Architect / consultants' shall mean M/S Taneja Associates Pvt. Ltd, E-32, South Extension One, New Delhi - 110049'Project Management Consultant' shall mean ----------Not Applicable ----------

1.1.2 'Site Engineer' shall mean an Engineer appointed by the Bank as their representative to give instructions to the contractor.

1.1.3 'The Contractor' shall mean the individual or firm or company whether incorporated or not, undertaking the works and shall include legal personal representative of such individual or the composing the firm or company and the permitted assignees of such individual or firm or company.

The expression 'Works' or 'Work' shall mean the permanent or temporary work described in the 'Scope of Work' and / or to be executed in accordance with the contract and includes materials, apparatus, equipment's, temporary supports, fittings and things of all kinds to be provided, the obligations of the contractor hereunder and work to be done by the contractor under the contract.

1.1.4 'Engineer' shall mean the representative of the Architect/ Consultant.

1.1.5 'Drawings' shall mean the drawings prepared by the Architects and issued by the Engineer and referred to in the specifications and any modifications of such drawings as may be issued by the Engineer from time to time 'Contract value shall mean the value of the entire work as stipulated in the letter of acceptance of tender subject to such additions thereto or deductions there from as may be made under the provision herein after contained.

1.1.6 'Specifications' shall mean the specifications referred to in the tender and any modifications thereof as may time to time be furnished or approved by the Architects/ consultant.

1.1.7 "Month" means calendar month.

1.1.8 'Week' means seven consecutive days.

1.1.9 'Day" means a calendar day beginning and ending at 00 hr. and 24 hrs. respectively.

CLUASE

1.0 Total Security Deposit

Total Security Deposit comprise of
Earnest Money deposit
Initial security deposit
Retention money

a) Earnest Money Deposit:

The tenderer shall furnish EMD as specified in the NIT in the form of Demand draft drawn in favor of the State Bank of India on any Scheduled Bank. No tender shall be considered unless the EMD is so deposited in the required form. No interest shall be paid on this EMD. The EMD of the unsuccessful tenderer shall be refunded soon after the decision to award the contract is taken without interest. The EMD shall stand absolutely forfeited if the tenderer revoke his tender at any time during the period when he is required to keep his tender open for acceptance by the SBI or after it is accepted by the SBI the contractor fails to enter into a formal agreement or fails to pay the initial security deposit as stipulated or fails to commence the work within the stipulated time.

b) Initial Security Deposit(ISD)

The ISD shall be as per NIT and shall be deposited within 15 days from the date of acceptance of tender.

c) Retention Money:

Besides the ISD as deposited by the contractor in the above said manner the retention money shall be deducted from the running account bill at the rate of 10% of the gross value of work done by the contractor and claimed in each bill provided the total security deposit i.e. the ISD plus retention money shall both togethernotexceed5%ofcontractvalue.50%ofthetotalsecuritydepositshallbe

refunded to the contractor without any interest on issue of Virtual Completion Certificate by the Architect/ Consultant. The balance 50% of the total security deposit shall be refunded to the contractor without any interest within fifteen days after the end of defect liability period provided the contractor has satisfactorily attended to all defects in accordance with the conditions of contract including site clearance.

2.0 Language

The language in which the contract documents shall be drawn shall be in English.

3.0 Errors, omissions and discrepancies

In case of errors, omissions and / or disagreement between written and scaled dimensions on the drawings or between the drawings and specifications etc., the following order shall apply:

i) Between scaled and written dimension (or description) on a drawing, the latter shall be adopted.

ii) Between the written or shown description or dimensions in the drawings and the corresponding one in the specification the former shall be taken as correct.

iii) Between written description of items in the specifications and description in bills of quantities of the same former shall be adopted.

a) In case of difference between rates written in figures and words, the rate in word shall prevail.

b) Between the duplicate/ subsequent copies of the tender, the original tender shall be taken as correct.

4.0 Scope of work:

The contractor shall carryout complete and maintain the said work in every respect strictly in accordance with this contract and with the directions of and to the satisfaction of the Bank to be communicated through the Architect/ Consultant. The Architect/ Consultant at the directions of the Bank from time to time, issue further drawings and/ or written instructions, detail directions and explanations which are hereafter collectively referred to as the Architect/ Consultant's instructions in regard to the variation or modification of the design, quality or quantity of work or the addition or omission or submission of any work. Any discrepancy in the drawings or between the BOQ and/ or drawings and/ or specifications, the removal from the site of any material brought thereon by the Contractor and any submission of any other materials thereof the removal and or re-execution of any work executed by him, the dismissal from the work of any person employed/ engaged thereupon.

5.0

(I) Letter of acceptance:

Within the validity period of the tender, the Bank shall issue a letter of acceptance either directly or through the Architect/ Consultant by registered post or otherwise depositing at the address of the contractor as given in the tender to enter into a Contract for the execution of the work as per the terms of the tender. The letter of acceptance shall constitute a binding contract between the SBI and the contractor.

(II) Contract Agreement:

On receipt of intimation of the acceptance of tender from the SBI/ Architect the successful tenderer shall be bound to implement the contract and within Seven days thereof. He shall sign an agreement on a non judicial stamp paper of appropriate value.

6.0 Ownership of drawings:

All drawings, specifications and copies thereof furnished by the SBI through its Architect / Consultants are the properties of the SBI. They are not to be used on other work.

7.0 Detailed drawings and instructions:

The SBI through its Architect / Consultants shall furnish with reasonable promptness additional instructions by means of drawings or otherwise, necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the contract document, true developments thereof and reasonably inferable there from.

The work shall be executed in conformity therewith and the contractor will prepare a detailed program schedule indicating therein the date of start and completion of various activities on receipt of the work order and submit the same to the SBI through its Architect /Consultant.

8.0 Copies of agreement

Two copies of agreement duly signed by both the parties (Bank & the Contractor) with the drawings shall be prepared one each for both the parties; a photo copy of such Agreement shall be kept by the Architect.

9.0 Liquidating damages:

If the contractor fails to maintain the required progress or to complete the work and clear the site including vacating their office on or before the contracted or extended date or completion without justification in support of the cause of delay, he may be called upon without prejudice to any other right of remedy available under the law to the SBI on account of such breach to pay a liquidated damages as mentioned in NIT

10.0 Materials, Appliances and employees:

Unless or otherwise specified the contractor shall provide and pay for all materials, labor, water, power, tools, equipment, transportation and any other facilities that are required for the satisfactory execution and completion of the work. Unless or otherwise specified. All materials shall be new and both workmanship and materials shall be of best quality. The contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or any one not skilled in the work assigned to him. Workman whose work or behavior is found to be unsatisfactory by the SBI/ Architect/Consultant shall be removed from the site immediately.

11.0 Permits, laws and Regulations:

Permits and licenses required for the execution of the work shall be obtained by the contractor at his own expenses. The contractor shall give notice and comply with the regulations, laws, and ordinances, rules, applicable to the contract. If the contractor observes any discrepancy between the drawings and specifications, he shall promptly notify the SBI in writing under intimation of the Architect/Consultant. If the contractor performs any act which is against the law, rules and regulations he shall meet all the costs arising there from and shall indemnity the SBI any legal actions arising therefrom.

12.0 Setting out work:

The contractor shall set out the work and shall be responsible for the true and perfect setting out the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and got it approved by the Architect/Consultant before proceeding with the work at any time any error in this respect shall appear during the progress of the works, irrespective of the fact that the layout had been approved by the Architect/Consultant the contractor shall be responsible for the same and shall at his own expenses rectify such error, if so, required to satisfaction of the SBI.

13.0 Protection of works and property:

The contractor shall continuously maintain adequate protection, of all his work from damage and shall protect the SBI's properties from the injury or loss arising in connection with contract. He shall make good any such damage, injury, loss, except due to causes beyond his control and not due to his fault or negligence.

He shall take adequate care and steps for protection of the adjacent properties. The contractor shall take all precautions for safety and protections of his employees on the works and shall comply with all applicable provisions of Govt. and local body's safety laws and building codes to prevent accidents or injuries to persons or property on about or adjacent to his place of works.

14.0 Inspections of work:

The SBI/ Architect/Consultant or their representatives shall at all reasonable times have free access to the work site and/ or to the workshop, factories, or other places where materials are laying or from where they are obtained and the contractor shall give every facility to the SBI/ Architect/Consultant and their representatives necessary for inspection and examination and test of the materials and workmanship. No person unless authorized by the SBI/ Architect/Consultant except the representative of Public authorities shall be allowed on the work at any time. The proposed work either during its construction stage or its completion can also be inspected by the Chief Technical Examiner's organization a wing of Central Vigilance commission.

15.0 Assignment and subletting:

The whole of work included in the contract shall be executed by the contractor and he shall not directly entrust and engaged or indirectly transfer, assign or underlet the contract or any part or share thereof or interest therein without the written consent of the SBI though the Architect and no undertaking shall relieve the contractor from the responsibility of the contractor form active superintendence of the work during its progress.

16.0 Quality of materials, workmanship & Test

i) All materials and workmanship shall be best of the respective kinds described in the contract and in accordance with the Architect/Consultant's instruction and shall be subject from time to time to such test as the Architect/Consultant may direct at the place of manufacture or fabrication or on the site or in an approved testing laboratory. The contractor shall provide such assistance, instruments, machinery, labor and materials as are normally required for examining, measuring, sampling and testing any material or part of work before incorporation in the work for testing a may be selected and required by the Architect/Consultant.

ii) Samples

All samples of adequate numbers, size, shades & pattern as per specifications shall be supplied by the contractor without any extra charges. If certain items proposed to be used are of such nature that samples cannot be presented or prepared at the site detailed literature/ test certificate of the same shall be provided to the satisfaction of the Architect/Consultant,. Before submitting the sample/ literature the contractor shall satisfy himself that the material/ equipment for which he is submitting the sample/ literature meet with the requirement of tender specification. Only when the samples are approved in writing by the Architect/Consultant the contractor shall proceed with the procurement and installation of the particular material/ equipment. The approved samples shall be signed by the Architect/Consultant for the identification and shall be kept on record at site office until the completion of the work for inspection/ comparison at any time. The Architect/Consultant shall take responsibility time to approve the sample. Any delay that might occur in approving the samples for reasons of its not meeting the specifications or other discrepancies, inadequacy, delay in furnishing samples of best qualities from various manufactures and such other aspects causing delay on the approval of the material/ equipment etc. shall be to the account of the contractor.

iii) Cost of Tests

The cost of making any test shall be borne by the contractor if such test is intended by or provided for in the condition or specifications or BOQ.

iv) Cost of test not provided for

If any test is ordered by the Architect/Consultant which is either

a) If so intended by or provide for or (in the cases above mentioned) is not so particularized, or though so intended or provided for but ordered by the Architect/Consultant to be carried out by an independent person at any place other than the site of the place of manufacture or fabrication of the materials tested or any Government/ approved laboratory, then the cost of such test shall be borne by the contractor.

17.0 Obtaining information related to execution of work:

No claim by the contractor for additional payment shall be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting the execution of the work or any misunderstanding or the obtaining incorrect information or the failure to obtain correct information relieve him from any risks or from the entire responsibility for the fulfillment of contract.

18.0 Contractor's superintendence

The contractor shall give necessary personal superintendence during the execution of the works and as long, thereafter, as the Architect/ Consultant may consider necessary until the expiry of the defects liability period, stated hereto.

19.0 Quantities:

i) The bill of quantities (BOQ) unless or otherwise stated shall be deemed to have been prepared in accordance with the Indian Standard method of Measurements and quantities. The rate quoted shall remain valid for variation of quantity against individual item to any extent subject to maximum variation of the contract value by 25%. The entire amount paid under clause 21 hereof as well as amount of prime cost and provisional sums if any shall be excluded.

ii) **Variation exceeding 25%:** The items of work executed in relation to variation exceeding 25% shall be paid on the basis of provisions of clause 22 (e)hereof.

20.0 Works to be measured

The Architect/Consultant may from time to time intimate to the contractor that he requires the work to be measured and the contractor shall forthwith attend or send a qualified representative to assist the Architect in taking such measurements and calculations and to furnish all particulars or to give all assistance required by any of them. Such measurements shall be taken in accordance with the mode of Measurements detailed in the specifications. The representative of the Architect/Consultant shall take the joint measurements with the contractor's representative and the measurements shall be entered in the measurement book. The contractor or his authorized representative shall sign all the pages of the measurement book in which the measurements have been recorded in token of his acceptance. All the corrections shall be duly attested by both representatives. No over writings shall be made in the measurement book. Should the contactor not attend or neglect or omit to depute his representative to take measurements then the measurements recorded by the representative of the Architect/Consultant shall be final. All authorized extra work, omissions and all variations made shall be included in such measurement.

21.0 Variations

No alteration, omission or variation ordered in writing by the Architect/ Consultant shall vitiate the contract. In case the SBI/ Architect/Consultant thinks proper at any time during the progress of works to make any alteration in, or additions to or omissions from the works or any alteration in the kind or quality of the materials to be used therein, the Architect/Consultant shall give notice thereof in writing to the contractor or shall confirm in writing within seven days of giving such oral instructions, the contractor shall alter to, add to, or omit from as the case may be in accordance with such notice, but the contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or

any deviation from any of the provisions of the contract, stipulations, specifications or contract drawings without previous consent in writing of the Architect/Consultant and the value of such extras, alternations, additions or omissions shall in all cases be determined by the Architect/Consultant and the same shall be added to or deducted from the contract value, as the case maybe.

22.0 Valuation of variations:

No claim for an extra shall be allowed unless it shall have been executed under the authority of the Architect/Consultant with the concurrence of the SBI as herein mentioned. Any such extra is herein referred to as authorized extra and shall be made in accordance with the following provisions.

a)

i) The net rates or prices in the contract shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced herein.

ii) Rates for all items, wherever possible should be derived out of the rates given in the priced BOQ.

b) The net price of the original tender shall determine the value of the items omitted, provided if omissions do not vary the conditions under which any remaining items of works are carried out, otherwise the prices for the same shall be valued under sub-clause (c)hereunder.

c) Where the extra works are not of similar character and/ or executed under similar conditions are aforesaid or where the omissions vary the conditions under which any remaining items or works are carried out, then the contractor shall within 7 days of the receipt of the letter of acceptance inform the Architect/Consultant of the rate which he intends to charge for such items of work, duly supported by analysis of the rate or rates claimed and the Architect/Consultant shall fix such rate or prices as in the circumstances in his opinion are reasonable and proper, based on the market rate.

d) Where extra work cannot be properly measured or valued the contractor shall be allowed day work prices at the net rats stated in the tender of the BOQ or, if not, so stated then in accordance with the local day work rates and wedges for the district; provided that in either case, vouchers specifying the daily time (and if required by the Architect/Consultant) the workman's name and materials employed be delivered for verifications to the Architect/Consultant at or before the end of the week following that in which the work has been executed.

e) It is further clarified that for all such authorized extra items where rates cannot be derived from the tender, the Contractor shall submit rates duly supported by rate analysis worked on the "market rate basis" for material, labor, hire/running charges of equipment's and wastage etc. plus 15% toward establishment charges, contractor's overheads and profits. Such items shall not be eligible for escalation.

23.0 Final measurements:

The measurements and the valuation in respect of the contract shall be completed within one month of the virtual completion of the work.

24.0 Virtual Completion Certificate(VCC)

On successful completion of the entire works covered by the contract to the full satisfaction of the SBI, the contractor shall ensure that the following works has been completed to the satisfaction of the SBI.

a) Clear the site of all scaffolding, wiring, pipes, surplus materials, contractor's labor, equipment and machinery.

b) Demolish, dismantle and remove the contractor's site office, temporary works, structure including labor sheds/ camps and construction of other items and things whatsoever brought upon or erected at the site or any land allotted to the contractor by the SBI and not incorporated in the permanent works.

c) Remove all rubbish, debris etc. from the site and the land allotted to the contactor by the SBI and shall clear, level, and dress, compact the site as required by the SBI.

d) Shall put the SBI in undisputed custody and possession of the site and all land allotted by the SBI.

e) The contractor shall hand over the work in a peaceful manner to the SBI.

f) All defects/ imperfection have been attended and rectified as pointed out by the SBI to the full satisfaction of the SBI.

Upon the satisfactory fulfillment by the contractor as stated above, the contractor shall be entitled to apply to the Architect/Consultant is satisfied of the completion of the work. Relative to which the completion certificate has been sought, the Architect/Consultant shall within fourteen (14) days of the receipt of the application for virtual completion certificate, issue a VCC in respect of the work for which the VCC has been applied.

This issuance of a VCC shall be without prejudice to the SBI's rights and contractors liabilities under the contract including the contractor's liability for defect liability period nor shall the issuance of VCC in respect of the works or work at any site be construed as a waiver of any right or claim of the SBI against the contractor in respect of works or works at the site and in respect of which the VCC has been issued.

25.0 Work by other agencies:

The SBI / the Architect/Consultant reserve the rights to use premises and any portion of the site for execution of any work not included in the scope of this contract which it may desire to have carried out by other persons simultaneously and the contractor shall not only allow but also extend reasonable facilities for the execution of such work. The contractor however shall not be required to provide any plant or material for the execution of such work except by special arrangement with the SBI. Such work shall be carried out in such manner as not to impede the progress of the works included in the contract.

26.0 Insurance of works:

26.1

Without limiting his obligations and responsibilities under the contract, the contractor shall insure in the joint names of the SBI and the contractor against all loss or damages from whatever cause arising other than the excepted risks, for which he is responsible under the terms of contract and in such a manner that the SBI and contractor are covered for the period stipulated in clause 28 and 29 ofGCC and are also covered during the period of maintenance for loss or damage arising from a cause, occurring prior to the commencement of the period of maintenance and for any loss or damage occasioned by the contractor in the course of any operations carried out by him for the purpose of complying with his obligations under clause.

a) The works for the time being executed to the estimated current Contract value thereof, or such additional sum as may be specified together with the materials for incorporation in the works at their replacement value.

b) The constructional plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and otherthings.

c) Such insurance shall be effected with an insurer and in terms approved by the SBI which approval shall not be unreasonably withheld and the contractor shall whenever required produce to the Architect/Consultant the policy of insurance and the receipts for payment of the current premiums.

26.2 Damage to persons and property

The contractor shall, except if and so far as the contract provides otherwise indemnify the SBI against all losses and claims in respect of injuries or damages to any person or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the works and against all claims proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation of damages for or with respect to:

a) The permanent use or occupation of land by or any part thereof.

b) The right of SBI to execute the works or any part thereof, over, under, in or through any lands.

c) Injuries or damages to persons or properties which are unavoidable result of the execution or maintenance of the works in accordance with the contract.

d) Injuries or damages to persons or properties resulting from any act or neglect of the SBI, their agents, employees or other contractors not being employed by the contractor or for or in respect of any claim, proceedings damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the contractor, his servants or agents. Such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the SBI, their employees, or agents or other employees, or agents or other contractors for the damage or injury.

26.3 Contractor to indemnify SBI

The contractor shall indemnify the SBI against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the provision of these sub-clauses of 26.2

26.4 Contractor's superintendence

The contractor shall fully indemnify and keep indemnified the SBI against any action, claim, or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claim made under or action brought against SBI in respect of such matters as aforesaid the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expenses to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the SBI if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Architect/Consultant in this behalf.

26.5 Third party Insurance

26.5.1 Before commencing the execution of the work the contractor without limiting his obligations and responsibilities under clause 26.0 of GCC shall insure against his liability for any material or physical damage, loss, or injury which may occur to any property including that of SBI, or to any person, including any employee of the SBI, by or arising out of the execution of the works or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to clause26.0 thereof.

26.5.2 **Minimum amount of third party insurance**

Such insurance shall be effective with an insurer and in terms of approved by the SBI which approval shall not be reasonably withheld and at least the amount stated below. The contractor shall whenever required produce to the Architect / Consultant the policy or policies of insurance cover and receipts for payment of the current premiums.

The minimum insurance cover for physical property, injury and death is **Rs. 10lacsper occurrence with the number of occurrences limited to four**. After each occurrence contractor will pay additional premium necessary to make insurance valid for four occurrences always.

26.6 Accident or Injury to workman:

26.6.1 The SBI shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the employment of the contractor or any sub-contractor, save and expect an accident or injury resulting from any act or default of the SBI or their agents, or employees. The contractor shall fully indemnify and keep indemnified the SBI against all such damages and compensations, save and except as aforesaid and against all claims proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

26.6.2 Insurance against accidents etc. to workmen:

The contractor shall insure against such liability with an insurer approved by the SBI during the whole of the time that any person are employed by him on the works and shall, when required, produce to the Architect/Consultant such policy of insurance and receipt for payments of the current premium. Provide always that, in respect of any persons employed by any sub-contractor, the contractor's obligation to insure as aforesaid under this sub-clause shall be satisfied if the sub contractor shall have insured against the liability in respect of such persons in such manner that SBI is indemnified under the policy but the contractor shall require such sub-contractor to produce to the Architect/Consultant when such policy of insurance and the receipt for the payment of the current premium.

26.6.3 Remedy on Contractor's failure to insure:

If the contractor fails to effect and keep in force the insurance to above referred to above or any other insurance which he may be required to effect under the terms of contract, then and in any such case the SBI may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the SBI as aforesaid from any amount due or which may become due to the contractor, or recover the same as debt from the contractor.

Without prejudice to the other rights of the SBI against the contractor, in respect of such default, the employer shall be entitled to deduct from any sums payable to the contractor the amount of any damages, costs, charges, and other expenses paid by the SBI and which are payable by the contractor under this clause. The contractor shall upon settlement by the insurer of any claim made against the insurer pursuant to a policy taken under this clause, proceed with due diligence to rebuild or repair the works destroyed or damaged. In this event all the monies received from the insurer in respect of such damage shall be paid to the contractor and the contractor shall not be entitled to any further payment in respect of the expenditure incurred for rebuilding or repairing of the materials or good destroyed or damaged.

27.0 Commencement of Works:

The date of commencement of the work will be reckoned as the date of handing over site or fifteen days from the date of issue of letter of acceptance of the tender by the SBI whichever is later.

28.0 Time of completion:

Time is essence of the contract and shall be strictly observed by the contractor. The entire work shall be completed within as specified in the NIT from the date of commencement. If required in the contract or as directed by the Architect/Consultant, the contractor shall complete certain portions of work before completion of the entire work. However the completion date shall be reckoned as the date by which the whole work is completed as per the terms of the contract.

29.0 Extension of time:

If, in the opinion of the Architect/Consultant, the work be delayed for reasons beyond the control of the contractor, the Architect/Consultant may submit a recommendation to the SBI to grant a fair and reasonable extension of time for completion of work as per the terms for contract. If the contractor needs an extension of the time for completion of the work or if the completion of work is likely to be delayed for any reasons beyond the due date of completion as stipulated in the contract, the contractor shall apply to the SBI through the Architect/Consultant in writing at least 30 days before the expiry of the scheduled time and while applying for extension of time he shall furnish the reasons in detail and his justification if any, for the delays. The Architect/Consultant shall submit their recommendations to the SBI in the prescribed format for granting extension of time. While granting extension of time the contractor shall be informed the period extended times, which will quality for levy of liquidated damages. For the balance period in excess of original stipulated period and duly sanctioned extensionoftimebytheSBI.Theprovisionofliquidateddamagesasstatedunder

clause 9 of GCC shall become applicable. Further the correct shall remain in force even for the period beyond the due date of completion irrespective whether the extension is granted or not.

30.0 Rate of progress:

Whole of the materials, plant and labor to be provided by the contractor and the mode, manner and speed of execution and maintenance of the works to be of a kind and conducted in a manner to the satisfaction of the Architect/Consultant should the rate of progress of the work or any part thereof be at any time be in the opinion of the Architect/Consultant too slow to ensure the completion of the whole of the work by the prescribed time or extended time for completion the Architect/Consultant shall thereupon take such steps as considered necessary by the Architect/Consultant to expedite progress so as to complete the works by the prescribed time or extended time. Such communications from the Architect/Consultant neither shall relieve the contractor from fulfilling obligations under the contract nor will he be entitled to raise any claims arising out of such directions.

31.0 Work during nights and holidays:

Subject to any provision to the contrary contained in the contract no permanent work shall save as herein provided be carried on during the night or on holidays without the permission in writing of the Architect/Consultant, save when the work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the work in which case the contractor shall immediately advise the Architect/Consultant. However, the provisions of the clause shall not be applicable in the case of any work which becomes essential to carry by rotary or double shifts in order to achieve the progress and quality of the part of the work being technically required/ continued with the prior approval of the Architect/Consultant at no extra cost to the SBI.

All work at night after obtaining approval from competent authorities shall be carried out without unreasonable noise and disturbance.

32.0 No compensation for restrictions of work:

If at any time after acceptance of the tender SBI shall deduct to abandon or reduce the scope of work for any reason whatsoever and hence not required the whole or any part of the work to be carried out, the Architect/Consultant shall give notice in writing to that effect to the contactor and the contactor shall act accordingly. In the matter the contactor shall have no claim to any payment of compensation or otherwise whatsoever on account of any profit or advantage which he might have derived from the execution of the work fully but which he did not derive in consequences of the foreclosure of the whole or part of the work.

Provided that the contactor shall be paid the charges on the cartage only of materials actually and bonafide brought to the site of the work by the contactor and rendered surplus as a result of the abandonment, curtailment of the work or any position thereof and taken back by the contactor, provided however that the Architect/Consultant shall have in such cases the opinion of taking over all or any such material at their purchase price or at local current rate whichever is less.

"In case of such stores having been issued form SBI stores and returned by the contactor to stores, credits shall be given to him at the less rate not exceeding those at which were originally issued to the contactor after taking into consideration and deduction for claims on account of any deterioration or damage while in the custody of the contactor and in this respect the decision of the Architect/Consultant shall be final.

33.0 Suspension of work:

i) The contactor shall, on receipt of the order in writing of the Architect/Consultant (whose decision shall be final and binding on the contractor) suspend the progress of work or any part thereof for such time and in such manner as the Architect/Consultant may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

a) On account any default on the part of the contractor, or

b) For proper execution of the works or part thereof for reasons other than the fault of the contactor or

c) For safety of work or part thereof, the contactor shall during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Architect/Consultant.

ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above, the contactor shall be entitled to an extension of time equal to the period of every such suspension. No compensation whatsoever shall be paid on this account.

34.0 Action when the whole security deposit is forfeited

In any case in which under any clause or clauses of this contract, the contactor shall have rendered himself liable to pay compensation amounting to the whole of his security deposit the Architect/Consultant shall have the power to adopt any of the following course as they may deem best suited to the interest of the SBI.

a) To rescind the contact (of which rescission notice in writing to the contactor by the Architect/Consultant shall be conclusive evidence) and in which case the security deposit of the contactor shall be forfeited and be absolutely at the disposal of SBI.

b) To employ labor paid by the SBI and to supply materials to carry out the work, or any part of the work, debiting the contactor with the cost of the labor and materials (the cost of such labor and materials as worked out by the Architect/Consultant shall be final and conclusive against the contractor.) and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract, the certificate of the Architect/Consultant as to the value of work done shall be final and conclusive against the contractor.

c) To measure up the work of the contractor, and to take such part thereof as shall be unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount of which excess the certificates in writing of the Architect/Consultant shall be final and conclusive) shall be borne by original contractor and may be deducted from any money due to him by the SBI under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or sufficient part thereof.

In the event of any of above courses being adopted by the SBI the contractor shall have no claim for compensation for any loss sustained by him by reasons of his having purchased or procured any material or entered into any engagements or make any advances on account of, or with a view to the execution of the work or the performance of the contract and in case the contract shall rescind under the provision aforesaid, the contractor shall not be entitled to recover or to be paid any sum or any work thereto for actually performed under this contract, unless, and until the Architect/Consultant will have certified in writing the performance of such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

35.0 Owner's right to terminate the contract:

If the contractor being an individual or a firm commit any 'Act of Insolvency' or shall be adjusted an Insolvent or being an incorporated company shall have an order for compulsory winding up voluntarily or subject to the supervision of Govt. and of the Official Assignee of the liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him to do so, to show to the reasonable satisfaction of the Architect/Consultant that he is able to carry out and fulfill the contract and to give security therefore if so required by the Architect/Consultant.

Or if the contractor (whether an individual firm or incorporated company) shall suffer execution to be issued or shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the contractor.

Or shall assign or sublet this contract without the consent in writing of the SBI through the Architect/Consultant or shall charge or encumber this contract or any payment due to which may become due to the contractor there under:

a) has abandoned the contract ;or

b) has failed to commence the works, or has without any lawful excuse under these conditions suspended the progress of the works for 14 days after receiving from the SBI through the Architect/Consultant written notice to proceed, or

c) has failed to proceed with the works with such diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or has failed to remove the materials from the site or to pull down and replace work within seven days after written notice from the SBI through the Architect/Consultant that the said materials were condemned and rejected by the Architect/Consultant under these conditions; or has neglected or failed persistently to observe and perform all or any of the acts, matters or things by this contract to be observed and performed by the contractor for seven days after written notice shall have been given to the contractor to observe or perform the same or has to the detriment of good workmanship or in defiance to the SBI's or the Architect/Consultant's instructions to the contrary subject any part of the contract. Then and in any of said cases the SBI and or the Architect/Consultant, may not withstanding any previous waiver, after giving seven days notice in writing to the contractor, determine the contract, but without thereby affecting the power the SBI or the Architect/Consultant or the obligation and liabilities of the contractor the whole of which shall continue in force as fully as if the contract had not been so determined and as if the works subsequently had been executed by or on behalf of the contractor. And further the SBI through the Architect/Consultant their agents or employees may enter upon and take possession of the work and all plants, tools, scaffoldings, materials, sheds, machineries lying upon the premises or on the adjoining lands or roads use the same by means of their own employees or workmen in carrying on and completing the work or by engaging any other contractors or persons to complete the work and the contractor shall not in any was interrupt or do any act, matter or thing to prevent or hinder such other contractor or other persons employed for completing and finishing or using the materials and plant for the works.

When the works shall be completed as soon thereafter as convenient the SBI or the Architect/Consultant shall give a notice in writing to the contractor to remove his surplus materials and plants and should the contractor fail to do so within 14 days after receipt thereof by him the SBI sell the same by public auction after due publication, and shall adjust the amount released by such auction. The contractor shall have o right to question any of the acts of the SBI incidental to the sale of the materials etc.

36.0 Certificate of payment:

The contractor shall be entitled under the certificates to be issued by the Architect/Consultant to the contractor within 10 working days from the date of receipt of certificate to the payment from SBI from time to time. The SBI shall recover the statutory recoveries other dues including the retention amount from the certificates of payments.

They shall provide always that the issue of any certificate by the Architect/Consultant during the progress of works or completion shall not have effect as certificate of satisfaction or relive the contractor from his liability under clause.

The Architect/Consultant shall have power to withhold the certificate if the work or any part thereof is not carried out to their satisfaction.

The Architect/Consultant may by any certificate make any corrections required in previous certificate.

The SBI shall modify the certificate of payments as issued by the Architect/Consultant from time to time while making the payment.
The contractor shall submit interim bills only after taking actual measurements and properly recorded in the M books.

The contractor shall not submit interim bills when the approximate value of work done by him is less than **Rs 12.50acs** and the minimum interval between one such bills shall be **30 days**.

The final bill may be submitted by the contractor within a period of one month from the date of virtual completion and the Architect/Consultant shall issue the certificate of payment within a period of two months. The SBI shall pay the amount within a period of three months from the date of issue of certificate provided there is no dispute in respect of rates and quantities etc.

The contractor shall submit the interim bills in the prescribed format with all details.

37.0 SETTLEMENT OF DISPUTES ANDARBITRATION:

Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instruction, orders or these conditions or otherwise concerning the work or the execution or failure to execute the same whether

arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter.

i) If the contractor consider that he is entitled to any extra payment or compensation in respect of the works over and above the amounts admitted as payable by the Architect or in case the contractor wants to dispute the validity of any deductions or recoveries made or proposed to be made from the contract or raise any dispute, the contractor shall forthwith give notice in writing of his claim, or dispute to the **Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;** and endorse a copy of the same to the Architect, within 30 days from the date of disallowance thereof or the date of deduction or recovery. The said notice shall given full particulars of the claim, grounds on which it is based and detailed calculations of the amount claimed and the contractor shall not be entitled to raise any claim nor shall the Bank be in any way liable in respect of any claim by the contractor unless notice of such claim shall have been given by the contractor to the **Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;,** in the manner and within the time as aforesaid. The contractor shall be deemed to have waived and extinguished all his rights in respect of any claim not notified to the **Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;** in writing in the manner and within the time aforesaid.

ii) **The Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;,** shall give his decision in writing on the claims notified by the contractor. The contractor may within 30 days of the receipt of the decision of **The Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;** submit his claims to the conciliating authority namely the **Circle Development Officer, SBI, New Delhi** for conciliation along with all detail and copies of correspondence exchanged between him and the **Assistant General Manager (P & E) (LHO- Delhi), State Bank of India,11 Parliament Street, New Delhi -110001;,.**

iii) If the conciliation proceedings are terminated without settlement of the disputes, the contractor shall, within a period of 30 days of termination thereof shall give a notice to the concerned **CHIEF GENERAL MANAGER** of the Bank for appointment of an arbitrator to adjudicate the notified claims failing which the claims of the contractor shall be deemed to have been considered absolutely barred and waived.

iv) Except where the decision has become final, binding and conclusive in terms of the contract, all disputes or differences arising out of the notified claims of the contractor as aforesaid and all claims of the Bank shall be referred for adjudication through arbitration by the Sole Arbitrator appointed by the **CHIEF GENERAL MANAGER of the Bank**. It will also be no objection to any such appointment that the Arbitrator so appointed is a Bank Officer and that he had to deal with the matters to which the contract relates in the course of his duties as Bank Officer. If the arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another sole arbitrator shall be

appointed in the manner aforesaid by the said **CHIEF GENERAL MANAGER of the Bank**. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each dispute along with the notice for appointment of arbitrator.

It is also a term of this contract that no person other than a person appointed by such **CHIEF GENERAL MANAGER of the Bank** as aforesaid should act as arbitrator.

The conciliation and arbitration shall be conducted in accordance with the provisions of the Arbitration & Conciliation Act 1996 or any statutory modification or reenactment thereof and the rules made there under.

It is also a term of this contract that if any fees are payable to the arbitrator, these shall be paid equally by both the parties. However, no fees will be payable to the arbitrator if he is a Bank Officer.

It is also a term of this contract that the arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims. The venue of the arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The fees, if any, of the arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of parties. The cost of the reference and of the award (including the fees, if any, of the arbitrator) shall be in the discretion of the arbitrator who may direct to any by whom and in what manner, such costs or any part thereof, shall be paid and fix or settle the amount of costs to be so paid.

38.0 Water Supply

The contractor shall make his own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions:

i. That the water used by the Contractor shall be fit for construction purpose to the satisfaction of the Architect/Consultant.

ii. The Contractor shall make alternative arrangements for the supply of water if the arrangements made by the Contractor for procurement of water in the opinion of the Architect/Consultant is unsatisfactory.

iii. The Contractor shall construct temporary well/tube well in SBI land for taking water for construction purposes only after obtaining permission in writing from the SBI. The contractor has to make his own arrangements for drawing and distributing the water at his own cost. He has to make necessary arrangements. To avoid any accidents or damages caused due to construction and subsequent

maintenanceofthewells.Hehastoobtainnecessaryapprovalsfromthelocalauthorities, if required at his own cost. He shall restore the ground to its original condition after wells are dismantled on completion of work or hand over the well to the SBI without any compensation as directed by the Architect/Consultant.

39.0 Power Supply:

The contractor shall make his own arrangements for power and supply/distribution system for driving plant or machinery for the work and for lighting purpose at his own cost. The cost of running and maintenance of the plants are to be included in his tender prices. He shall pay all fees and charges required for the power supply and include the same in his tendered rates and hold the owner free from all such costs. He has to obtain necessary approvals from the appropriate authorities, if required.

40.0 Treasure trove etc.:

Any treasure trove, coin or object antique which may be found on the site shall be the property of the SBI and shall be handed over to the bank immediately.

41.0 Method of measurements:

Unless otherwise mentioned in the schedule of quantities or in mode of measurement or elsewhere in these documents the measurement will be on the net quantities or work produced in accordance with up to date as per rules laid down by the Bureau of Indian Standards. In the event any dispute/disagreement the decision of the Architect/Consultant shall be final and binding on the contractor.

42.0 Maintenance of registers:

The contractor shall maintain the following registers as per the enclosed format at site of work and should produce the same for inspection of SBI/Architect/Consultant whenever desired by them. The contractor shall also maintain the records/registers as required by the local authorities/Government from time to time.

i) Register for secured advance
ii) Register for hindrance to work
iii) Register for running account bill
iv) Register for labor

43.0 PRICE VARIATION ADJUSTMENT (PVA) FOR ALL MATERIALS (INCLUDING CEMENT & STEEL) &LABOUR(Applicable only for completion period beyond 12months)

In partial modification of the provisions made elsewhere in this contract regarding rate quoted being not subject to any variations, price adjustments to the value of

work payable to the Contractor at tendered rates shall be made towards variations in the prices of materials and labour in the manner specified hereunder:-

If, after written order to commence the work and during the operative period of this contract including any authorized extensions of the original stipulated completion period:-

(a) There be any variation in the Consumer Price Index- General Index- for industrial workers (Base 1982=100) (source – data published from time to time Indian Labor Journal by the Labor Bureau, Government of India);

OR

(b) There be any variation in the All India Wholesale Price Index for all commodities (Base 1993-94=100) (as published from time to time in the RBI Bulletin based on the date issued by the Office of the Economic Advisor to the Government of India); 164 Price Variation Adjustment (PVA) towards (1) Labor Component and (2) Material Component shall be calculated in accordance with the formula A and B respectively, given below, subject to stipulations herein under mentioned:-

FORMULA (A) FOR LABOUR:

$$VL = 0.85\mathbf{P}\ \mathbf{x}\frac{K1}{100CO} \times (C1 - CO)$$

FORMULA (B) FOR MATERIALS:

$$VM = 0.85 \times (P-Y) \times \frac{K2}{100IO} \times (I1-IO)$$

Where –

VL = Amount of Price Variation Adjustment
Increase or decrease in rupees due to labor component

VM = Amount of Price Variation Adjustment
Increase or decrease in rupees on account of materials component

NOTE: Bill period (noted hereunder) signifies the period of actual execution and not date of measurement or preparation of bill.

P = Cost of work done during the period under consideration (bill period) excluding advances on materials and/or adjustments thereof.

Y = Cost of any other materials supplied/ arranged by the Bank at fixed price during the period under consideration (bill period)

K1 = Percentage of labour component calculated as indicated in Note (1) below.

K2 = Percentage of materials component as indicated in Note (2) below.

CO = Consumer Price Index – General Index Number for industrial workers (Base 1982 = 100) referred to at (a) above, ruling on the last due date of receipt of tenders, and as applicable to the centre, nearest to the place of work, for which the index is published)

C1 =Average of above mentioned Consumer Price Index number during the period under consideration (bill period)

IO = All India Wholesale Price Index number for all commodities referred to at (b) above, ruling on the last date for receipt of tenders and as applicable to the centre, nearest to the place of work for which the index is published.

I1 = Average of above mentioned monthly all India Wholesale Price Index numbers during the period under consideration (bill period).

NOTE (1): K1 shall be taken as under:-

Component of work	K 1
a) FURNITURE work including ancillary works and external work And RCC / tanks, septic tanks, etc. if any of sanitary and Plumbing work	30
b) Sanitary and plumbing works including fittings and fixtures (Internal work only)	20
c) FURNITURE installations work including fittings and fixtures (External and internal works)	20

NOTE (2): K2 shall be taken as under:-

Component of work	K 2
a) FURNITURE work including ancillary works as detailed Under Note (1) (a) above	70
b) Sanitary and plumbing works including fittings and fixtures As detailed under Note (1) (b) above	80
c) FURNITURE installations work including fittings and Fixtures as detailed under Note (1) (c) above	80

Stipulations:

i. PVA Clause is operative either way i.e. if the variations in above referred price indices are on the plus side. PVA shall be payable to the contractor and if they are on the negative side PVA shall be recoverable from the contractor for the respective bill period of occurrence offluctuations.

ii. The rates quoted by the Contractor shall be treated as firm for the value of work required to be done in the first 12months of the contract period from 166 the date of written order to commence work and no PVA is admissible on the same on any grounds whatsoever. The value of work required to be done during the first 12 months of the contract period shall be taken as 80% of the value of work to be done on pro-rata basis in 12 months as compared to the total stipulated completion period. No PVA is admissible on the value of work required to be done in first 12 months as worked out above, even if this value of work is actually done in a period longer than 12 months. However, in case of any delay in the first 12 months due to genuine reasons which are not attributable to the contractor and which are beyond his control, such period of delay will be deducted from 12 months and the value of work to be done will be 80% of the pro-rata value of work to be done in such reduced period on pro-ratabasis.

iii. (a) For works where the original stipulated period of completion is not more than 12 months, no PVA whatsoever is permissible under this clause. However, if the period of completion is delayed beyond 12 months on account of genuine reasons which are not attributable to the contractor and which are beyond his control, PVA will be admissible on the value of work done only in excess of value of work required to be done on a prorate basis in the first 12 months minus the period of such genuine delay.

(b) For purpose of admissibility of PVA all the cumulative period of extensions granted for reasons which are solely attributable to the contractor is excluded from the total extended period of the contracts and PVA shall not be admissible on the value of work done during such period of extensions, which are granted for keeping the contract current, but only due to reasons for which the contractor was solely responsible. Periods of extensions granted on account of genuine reasons which are not attributable to the contractor and which are beyond his control will however, be included in the period for which PVA is admissible.

(c) Notwithstanding anything to the contrary mentioned in any other clause/ clauses of the contract, extensions of the contract period shall be granted by the Architect only with prior approval of the Bank. Extensions granted by the Architect without Bank's prior approval shall not bind the Bank for payment of PVA for work done in the concerned period of extensions.

iv. (a) Where the total cost of work done beyond the value of work required to be done in the first 12 months (vide note (ii) and (iii) above does not exceed Rs.50 lacs the total amount of PVA worked out on the basis of provisions of foregoing stipulations will be limited to an upper ceiling of 10% of such value of work done in excess of value of work required to be done in the first 12 months, minus the cost of any materials issued/arranged by the Bank at fixed prices i.e. P – Y (these terms being as per definitions given formulae A and B above).

(b) Where the total value of work done beyond the value of work required to be done in the first 12 months exceeds Rs.50 lacs, the PVA on the first Rs.50 lacs will be calculated as provided for in the foregoing para and for the balance value of work done for which PVA is admissible subject to foregoing conditions, the PVA will have the upper ceiling of 10% but it will be worked out at a lower rate i.e. 80% of the amount worked out as per the formulae A and B referred to earlier.

v. In working out the amount of PVA as per all the foregoing stipulations, value of such extra items or such portions of extra items the rates of which are derived from the prevailing market rates of materials and labor will not be included in the value of work done. Value of only such extra items or such portions of extra items, rats of which are derived entirely from tendered rates will be included in the value of work on which PVA as calculated.

vi. For claiming the payment for PVA the contractor shall keep such books of accounts and other documents, vouchers receipts etc. as may be required by the Bank/Architect, for verification of the increased claims or reduction to be made as the case may be and he shall also allow Engineers and/or other duly authorized representatives of the Bank/Architects and furnish such information as may be required or called for to enable verification of the claim within a week of such request.

vii. The contractor is required to submit to the Bank, through the Architect, his claims for PVA separately for each running Bill for the individual bill periods for the work paid to him by the Bank. He will also be required to submit detailed calculations in support of the claims.

viii. No claim will be entertained from the contractor for interest or any other grounds for non-payment or for any delay in payment of PVA due to late publication or non-availability of the necessary price indices or due to delay in preparation of the Running or Final Bills.

ix. In view of adjustments for variations in process of materials and labor which have been covered in this clause no other adjustments for any reason whatsoever like statutory measures, taxes, levies, etc. will be allowed.

44.0 Force Majeure:

44.1 Neither contractor nor SBI shall be considered in default in performance of their obligations if such performance is prevented or delayed by events such as but not to war, hostilities revolution, riots, FURNITURE commotion, strikes, lockout, conflagrations, epidemics, accidents, fire, storm, floods, droughts, earthquakes or ordinances or any act of god or for any other cause beyond the reasonable control of the party affected or prevented or delayed. However a notice is required to be given within 30 days from the happening of the event with complete details to the other party to the contract, if it is not possible to serve a notice, within the shortest possible period without delay.

44.2 As soon as the clause of force majeure has been removed the party whose ability to perform its obligations has been affected, shall notify the other of such cessation and the actual delay incurred in such affected activity adducing necessary evidence in support thereof.

44.3 From the date of occurrence of a case of force majeure obligations of the party affected shall be suspended during the continuance of any inability so caused. With the cause it and inability resulting there from having been removed, the agreed time of completion of the respective obligations under this agreement shall stand extended by a period equal to the period of delay occasioned by such events.

44.4 Should one or both parties be prevented from fulfilling the contractual obligations by a state of force major lasting to a period of 6 months or more the two parties shall each other to decide regarding the future execution of this agreement.

45.0 Local laws, Acts, Regulations:

The contractor shall strictly adhere to all prevailing labor laws inclusive of contract labor (regulation and abolition act of 1970) and other safety regulation. The contractor shall comply with the provision of all labor legislation including the latest requirements of all the Acts, Laws, any other regulations that are applicable to the execution of the project.

i) Minimum Wages Act 1948 (Amended)
ii) Payment of Wages Act 1936(Amended)
iii) Workmen's Compensation Act 1923(Amended)
iv) Contract labor regulation and abolition act 1970 and central rules 1971 (amended)
v) Apprentice act 1961(amended)

vi) Industrial employment (standing order) Act 1946(amended)
vii) Personal injuries (compensation insurance) act 1963 and any other modifications
viii) Employees' provident fund and miscellaneous provisions Act 1952 and amendment thereof
ix) Shop and establishment Act
x) Any other act or enactment relating thereto and rules framed there under from time to time.

46.0 Safety Code:

1. All personnel at site should be provided with Helmets and Safety Boots with some identification Mark. Visitors also should be provided with helmets. It should be ensured that these are used properly.

2. First Aid Box should be kept at site with all requisite materials.

3. No one should be allowed to inspect / work at a height without safety belt.

4. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well as suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1 (¼ horizontal and 1vertical).

5. Scaffolding or staging more than 3.5 meters above the ground or floors, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

6. Working platforms, Gangways, and Stairways should be so constructed that they do not sag unduly or unequally, and if the height of the platform or the Gangway or the Stairway is more than 3-5 meters above ground level or floor level they should be closely boarded, should have adequate width and should be suitably fenced, as described.

7. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1meter.

8. Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 Meters in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including Meters in length. For longer ladders this width should be increased at least 6mm for each additional 30cms. Uniform step spacing shall not exceed30cms.

9. Adequate precautions shall be taken to prevent danger from electrical equipments. For electrical on line work gloves, rubber mats, and rubber shoes shall be used.

10. All trenches 1.2 Meters or more in depth shall at all times be supplied with at least one ladder for each 30 meters length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1Meter above the surface of the ground. The sides of the trenches, which are 1.5 meters or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 Meters of the edge of the trench or half of the depth of the trench whichever is more cuttings shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.

11. Before any demolition work is commenced and also during the process of the work:-

    (a) All roads and open areas adjacent to the work site shall either be closed or suitably protected;

    (b) No electrical cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.

    (c) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

(d) All necessary personal safety equipment as considered adequate by the site Engineer should be kept available for the use of the persons employed on the site and maintained in a condition suitable for immediate use; and the contractor should take adequate steps to ensure proper use of equipment by those concerned.

(e) Workers employed on mixing Asphaltic materials, Cement and lime mortars shall be provided with protective footwear and protective goggles.

(f) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles.

(g) Those engaged in welding works shall be provided with Welder's protective eye-shields.

(h) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

(i) When workers are employed in sewers and manholes, which are in use, the contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into the manholes so opened shall be cordoned off with suitable railing and provided with warning signals and boards to prevent accident to the public.

12. Use of hoisting machines and tackle including their attachments, anchorage and support shall conform to the following standard or conditions:-

(a) These shall be of good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good repairs and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

(c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in-charge of any hoisting machine including any scaffold, winch or give signals to the operator.

(d) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension the safe working load shall be ascertained by adequatemeans.

(e) Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of hoisting machine having a variable safe working load, each safe working load of the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

(f) Motor, gearing, Transmission, Electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards, hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load, adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced.

(g) When workers are employed on electrical installation, which are already energized, insulating mats, wearing apparel such as gloves, sleeves, and boots as may be necessary should be provided. The workers should not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.

13. All scaffolds, ladders and other safety devices, mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of work.

14. (i) These and all other necessary safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

(i) To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the labor officer, Engineers of the Department or their representatives.

(ii) Notwithstanding the above clauses, there is nothing in these to exempt the contractor from the operations of any other Act or rule in force in the Republic of India.

47.0 Accidents:

The contractor shall immediately on occurrence of any accident at or about the site or in connection with in execution of the work report such accident to the Architect/ Consultant. The contractor shall also such report immediately to the competent authority wherever such report is required to be lodged by the law and take appropriate actions thereof.

SPECIAL CONDITIONS OF CONTRACT

Scope of Work: As defined & explained in these tender documents.

1.0 Dimensions and levels

All dimensions and levels shown on the drawings shall be verified by the contractor on the site and he will be held responsible for the accuracy and maintenance of all the dimensions and the levels. Figured dimensions are in all cases to be accepted and no dimension shall be scaled. Large scale details shall take precedence over small-scale drawings. In case of discrepancy the contractor shall ask for clarification from the Architect/Consultant before proceeding with the work.

2.0 Notice of operation:

The contractor shall not carry out any important operation without the consent in writing from the Architect/Consultant.

3.0 Construction records:

The contractor shall keep and provide to the Architect/Consultant full and accurate records of the dimensions and positions of all new work and any other information necessary to prepare complete drawings recording details of the work as constructed.

4.0 Safety of adjacent structures and trees

The contractor shall provide and erect to the approval of the Architect/ Consultant such supports as may be required to protect effectively all structures and protective guards to trees which may be endangered by the execution of the works or otherwise take such permanent measures as may be required by the Architect to protect the trees and structures.

5.0 Temporary works:

Before any temporary works are commenced the contractor shall submit at least 7 days in advance to the Architect/Consultant for approval complete of all temporary works he may require for the execution of the works. The contractor shall carry out the modifications relating to strength, if required by the Architect/Consultant may require in accordance with the conditions of contract at his own cost. The contractor shall be solely responsible for the stability and safety of all temporary works and unfinished works and for the quality of the permanent works resulting from the arrangement eventually adopted for their execution.

6.0 Temporary roads

The contractor shall provide access road to the site from the nearest main road at no extra cost and as directed by the Architect/Consultant. The contractor shall also be responsible for proper maintenance of this access road and would take all care to see that existing services, if any, are maintained in working order at his own cost. The laying and maintaining the temporary roads within the site area shall be the contractor's responsibility and the contractor shall take such measures that are necessary and as directed by the Architect/Consultant.

7.0 Water, power, and other facilities:

a) The rate quoted by the contractor shall include all expenses that are required for providing all the water required for the work and the contractor shall make his own arrangements for the supply of good quality water suitable for the construction and good quality drinking water for their workers. If necessary the contractor has to sink a tube well/ open well and bring water by means of tankers at his own cost for the purpose. The SBI will not be liable to pay any charges in connection with the above.

b) The rate quoted in the tender shall include the expenses for obtaining and maintaining power connections and shall pay for the consumption charges.

c) The contractors for other trades directly appointed by the SBI shall be entitled to take power and water connections from the temporary water and power supply obtained by the contractor. However the concerned contractor shall make their own arrangements to draw the supply and pay directly the actual consumption charges at mutually agreed rates between them. All municipal charges for drainage and water connections for construction purposes shall be borne by the contractor and charges payable for permanent connections, if any, shall be initially paid by the contractor and the SBI will reimburses the amount on production of receipts.

d) The SBI as well as the Architect/ Consultant shall give all possible assistance to the contractors to obtain the requisite permission from the various authorities, but the responsibility for obtaining the same in time shall be of the contractor.

8.0 Office accommodation

a) The contractors shall provide and maintain all necessary offices, workshops, stores, shelters, sanitary facilities, canteens and other temporary structures for themselves in connections with the work at the site at their own cost after getting the approval from the Architect/Consultant.

b) A site office for the use of SBI/ the Architect/ Consultant shall be provided by the contractors at his own expenses.

c) All temporary buildings and facilities as mentioned above shall be removed on completion of the work or at any other earlier date as directed by the contractors.

All the expenses for obtaining statutory approvals and maintenance of the above facilities as well as running expenses shall be borne by the contractor at no extra cost. It is also the responsibility of the contractor to obtain statutory approvals for providing the above facilities

9.0 Facilities for Contractor's employees:

The contractor shall make his own arrangement for the housing and welfare of his staff and workmen including adequate drinking water facilities. The contractor shall also make the arrangement at his own cost for transport where necessary for his staff and workmen to and from site of work at his own cost.

10.0 Lighting of works:

The contractors shall at all times provide adequate and approved lighting as required for the proper execution and supervision and inspection of work.

11.0 Fire fighting arrangements:

i) The contractor shall provide suitable arrangement for firefighting at his own cost. For this purpose he shall provide requisite number of fire extinguishers and adequate number of buckets, some of which are to be always kept filled with sand and some with water. These equipment's shall be provided at suitable prominent and easily accessible places and shall be properly maintained.

ii) Any deficiency in the fire safety or unsafe conditions shall be corrected the contractor at his own cost and to the approval of the relevant authorities. The contractor shall make the following arrangements at his own cost but not limited to the following.

a) Proper handling, storage and disposal of combustible materials and waste.

b) Work operations which can create fire hazards

c) Access for firefighting equipment's.

d) Type, number and location of containers for the removal of surplus materials and rubbish.

e) Type, size, number and location of fire extinguishers or other fire fighting equipment's.

f) General housekeeping.

12.0 Site order book:

A site order book shall be maintained at the site for the purpose of quick communication with the Architect/ Consultant. Any communication relating to the works may be conveyed through records in the site order book. Such a communication from one party to the other shall be deemed to have been adequately served in terms of contract. Each site order book shall have machine numbered pages in triplicates and shall carefully maintained and preserved by the contractor and shall be made available to the Architect/ Consultant as an when demanded. Any instructions which the Architect/ Consultant may like to issue to the contactor or the contractors may like to bring to the Architect/ Consultant Two copies of such instructions shall be taken from the site order book and one copy will be handed over to the party against proper acknowledgement and the second copy will be retained for their record.

13.0 Temporary fencing/barricading

The contactor shall provide and maintain a suitable temporary fencing/ barricading and gates at his cost to adequately enclose all boundaries of the site for the protection of the public and for the proper execution and security of the work and in accordance with the requirement of the Architect/ Consultant and regulations of local authorities. These shall be altered, relocated and adopted from time to time as necessary and removed on completion of the work.

14.0 Site meetings:

Site meetings will be held to review the progress and quality evaluation. The contactor shall depute a senior representative along with the site representative and other staff of approved sub-contractors and suppliers as required to the site meetings and ensure all follow up actions. Any additional review meetings shall be held if required by the Architect/Consultant.

15.0 Disposal of refuse:

The contactor shall cart away all debris, refuse etc. arising from the work from the site and deposited the same as directed by the Architect/ Consultant at his own cost. It is the responsibility of the contactor to obtain approval from the local authorities concerned to the effect that all rubbish arising out of contractor's activities at the construction site or any other site activities borrow pits has been properly disposed off.

16.0 Contractor to verify site Measurements:

The contractor shall check and verify all site measurements wherever requested by other specialist contractors or other sub-contractors to enable them to prepare their

own shop drawings and pass on the information with sufficient promptness as will not in any way delay the works.

17.0 Displaying the name of the work:

The contractor shall put up a name board of suitable size as directed by the Architect/ Consultant indicating the name of the project and other details as given by the Architect/ Consultant at his own cost and remove the same on completion of work.

18.0 Bar bending schedule:

The contractor shall prepare a detailed bar bending schedule for all reinforced concrete works and got them approved by the Architect/ Consultant well in advance.

19.0 As built drawings:

i) For the drawings issued to the contractor by the Architect/ Consultant. The Architect/ Consultant will issue two sets of drawings to the contractor for the items for which some changes have been made from the approved drawings as instructed by the SBI/ the Architect/ Consultant. The contractor will make the changes made on these copies and return these copies to the Architect/ Consultant for their approval. In case any revision is required or the corrections are not properly marked, the Architect/ Consultant will point out the discrepancies to the contractor. The contractor will have to incorporate these corrections and/or attend to discrepancies either on the copies as directed by the Architect/ Consultant and resubmit to him for approval. The Architect/ Consultant will return one copy duly approved by him.

ii) For the drawings prepared by the contractor,
The contractor will modify the drawings prepared by him wherever the changes are made by the SBI/ the Architect/ Consultant and submit two copies of such modified drawings to the Architect/ Consultant for approval. The Architect/ Consultant will return one copy of the approved drawing to the contractor.

20.0 Approved make:

The contractor shall provide all materials from the list of approved makes at his own cost and also appoint the specialized agency for the waterproofing, anti- termite, aluminum doors and windows and any other items as specified in the tender. The Architect/ Consultant may approve any make/ agency within the approved list as given in the tender after inspection of the sample/ mock up.

21.0 Procurement of materials:

The contractor shall make his own arrangement to procure all the required materials for the work. All wastages and losses in weight shall be to the contractor's account.

22.0 Excise duty, Taxes, Levies etc.

The contractor shall pay and be responsible for payment of all taxes, duties, levies, royalties, fees, cess or charges in respect of the works including but not limited to sale taxes, tax on works contract excise duty and octroi, payable in respect of material, equipment's plant and other things required for the contract. All the aforesaid taxes, duties, levies, fees and charges shall be to the contractor's account and the SBI shall not be required to pay any additional or extra amount on this account. Variation of taxes, duties, levies, etc. if any, till completion of work shall be deemed to be included in the quoted rates and no extra claim on this account will in any case be entertained. If a new tax or duty or levy or cess or royalty or octroi is imposed under as statue or law during the currency of the contract/work the same shall be borne by the contractor.

23.0 Acceptance of tender:

The SBI shall have the right to reject any or all tenders without assigning any reason. They are not bound to accept the lowest or any tender and the tenderer or tenderers shall have no right to question the acts of the SBI. However adequate transparency would be maintained by the SBI.

24.0 Defects after Virtual completion and defects liability period:

Any defect shrinkage, settlement or other faults which may appear within the "Defects Liability Period" which shall be as per NIT from the date of the virtual completion of the work, arising in the opinion of the Architect from materials or workmanship not in accordance with the contract, shall upon the direction in writing of the Architect , and within such reasonable time as shall be specified therein, be amended and made good by the contractor, at his own cost and in case of default then Bank may employ and pay other person /agency to amend and make good such defects, shrinkage, settlement or other faults, and all damages, loss, and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damage, loss and expenses shall be recoverable from him by the Bank or may be deducted by the Bank, upon the Architect's certificate in writing, from any money due or may be deducted by the Bank, upon the Architect's certificate in writing, from any money due or that may become due to the contractor, or the bank may in lieu of such amending and marking good by the contractor deduct from any money due to the contractor a sum, to be determined by the Architect equivalent to the cost of amending such work and in the event of the amount retained under clause of GCC, hereof being insufficient, recover the balance from the contractor, together with any expenses the Bank may have incurred in connection therewith. Should any defective work

have been done or material supplied by any sub-contractor employed on the works, who has been nominated or approved by the Architect as provided in clauses of GCC the contractor shall be liable to make good in the same manner as if such work or material has been done or supplied by the Contractor and been subject to the provisions of this Contract. The Contractor shall remain liable under the provisions of this Contract notwithstanding the signing of any Certificate or the passing of any accounts, by the Architect.

ADDITIONAL CONDITIONS OF CONTRACT

Notwithstanding anything contained herein above the following ADDITIONAL CONDITIONS shall be applicable for this contract / work.

1.0 PRICE VARIATION ADJUSTMENT(PVA):

The rates quoted by the bidder shall remain firm throughout the contract / construction period. PVA & PVA Clause mentioned elsewhere in these documents shall not be applicable.

2.0 WORKING SCHEDULE / BARCHART:

Detailed working date schedule and bar chart for the work shall be prepared by the contractor and got approved from the Bank / Architect. A detailed flow chart of activities highlighting curing, setting time / period, pot life period / predecessor, successor & critical activities etc. shall also be prepared by the contractor for effective management of work and also to make a realistic bar chart / working date schedule.

3.0 RATES:

It may be noted that it is an item rate contract. Rates accepted by the bank shall be for all levels/height and lead unless otherwise specified in the schedule of quantities and shall be inclusive of temporary shifting and installation of furniture to keep branch functional , all man, labour, supervision, materials, tools, equipment, barricading, cordoning, covering scaffoldings, water, electricity, taxes, insurances, arrangements, temporary works, over heads, collection & carting away & final disposal of rubbish & debris, regular cleaning of site etc. required to complete the works in all respect to the satisfaction of the architects / Bank and nothing additional or extra shall be paid on these accounts and / or on account of variation in rates / taxes and / or imposition of new tax / levy during currency of contract / work, except for the items, taxes, works etc. for which there is a specific mention for additional payment in these tender documents. The rates shall remain firm throughout the contract period.

4.0 BASICRATE:

Wherever for any item of work basic rate of materials are specified, the materials of that basic rates as selected by the Bank/Architect at any commercial establishment/ seller of Ahmadabad or nearby centre, if such materials are not available at Ahmadabad, shall be procured and used by the contractor.

Basic rate of any material (Without processing) is the rate offered by seller against Bill and credit period not exceeding 15 days, including all applicable taxe setc (but excluding GST) ex- godown. Payments for procurement of materials shall be made by the contractor themselves.

If the basic rate of any material actually used for the work is more or less than the basic rate given in schedule of quantities, in that case adjustments in the rate admissible to the contractor shall be modified by adding or subtracting, as the case is, from the accepted tender rates an amount equivalent to difference in the basic rates plus 15 % of difference of the basic rate.

5.0 BRANDED / FINISHINGITEMS:

Branded items such as tiles, construction chemicals, hardware, sanitary wares and other finishing items shall be used as per the samples selected and approved by the architects / Bank from the brands/makes mentioned in the tender document. If the contractor intend to use an equivalent substitute than, they have to produce necessary documentary evidences establishing the equivalency to the satisfaction of the architect/Bank and shall use the same only after approval of the architect.

6.0 INSURANCE

The contractor shall keep the Bank indemnify from all the claims arising out of damage to workman/person & property of Bank and/or third party and the SBI shall have right to recover the cost of such damages /claim from any amount due to the contractor. If the claim amount exceeds the amount due to be paid to the contractor, the contractor shall immediately pay such excess amount to the Bank. Decision of the Bank regarding determination of the amount of claim /damage shall be final & binding to the contractor. Being a short period work, the Bank may not be able to check or verify the various insurance policies required to be taken by the contractor and trust that the contractor has obtained all such policies.

7.0 SITE CONDITION & WORKINGHOURS.

The tenderer must visit the site and acquaint themselves with the site conditions. It must be noted that the work is to be carried out in the functional branch without hindering the normal functioning of the Branch. The work may generally be carried out on holidays or after Banking hours.
Height of internal spaces of the branch is higher than normal structures. Average height of internal spaces of the structure in approx. 6 to 6.5 mts for hall and approx.
4.5 mts for rooms. The tenderer should examine all the existing site condition before quoting the rates. All the quoted rates are inclusive of required scaffolding works, lifting of material, carriage etc. Temporaray barricade & partitions/screens to be provided by contractor to safeguard bank users from proposed construction activities (for dust, noise, material fall etc.) with out any extra cost.

The Lift shall not be used by Contractor for any propose.

The contractor has to work in coordination with the other contractors and

daily/weekly schedule of working shall be prepared in consultation with the Architects/Banks. Regular updating / modification of such schedule shall be required.

For normal functioning of the Bank/Branch the contractor shall be required to shift the furniture etc and/or relocate the existing and/or new loose and/or fix furniture and/or any other item of works and/or any such materials at new location at times. The contractor shall carry out all such activities with utmost priority and without any additional/extra cost to the bank. The tenderer shall quote the rates inclusive of all such activities/works as may be required as per site conditions. The rates quoted by the tenderer shall be inclusive of all such temporary/semi-permanent works/activities.

8.0 GENERAL:

(i) Source of materials / samples / brands / makes etc. shall be got approved from the Architects /Bank before using. In case of deviations, decision of the Bank shall be final and binding and shall not be open for arbitration.

(ii) The Architects have their specific role/duties/rights as defined in these tender documents However in the event of any dispute arising out of differences between the opinions of the Architects and also their role/duties/rights, the Banks' decision shall be final & binding on the Architects and the Contractor and shall not be open to arbitration.

(vi) Any item mentioned in the BOQ with "TO THE SHAPE" will have measurement of onsite executed to the shape area only.

(vii) The contractor's qualified & authorized representative shall remain on site during the entire execution process for coordination with various agencies/ Architect/Bank & execution of work

(viii) Hidden measurement. It is contractor's responsibility to get the measurement checked immediately on completion of such items. This shall be done before finishing the same & before ceiling boarding done. The Architect shall be provided with such details well in advance so that the other work is not held up due to last moment action.

(ix) MTC (Manufacturer Test certificate) Where ever applicable shall be arranged &submitted by the contractor.

(x) Water & Electricity, if available, shall be provided by the Bank at one point without any charges. However, if the water & electricity could not be provided by the Bank, the same shall be arranged by the contractor at their own cost within the quoted/accepted rate. Nothing extra shall be paid by the Bank on account of not providing the water &Electricity.

(XI) Wherever the specifications are not specified in details the work shall be carried out as per CPWD specifications or Manufacturer's instructions or architects instructions depending upon the site conditions as directed by the Bank/Architects

(XII) The contractor shall produce the bills / challans / documentary evidences and proof in respect of genuineness of materials used by him when so ever asked/demanded by the Architects/Bank.

PERFORMA FOR APPLICATION BY CONTRACTOR FOR EXTENSION OF TIME

1. Name of the Contractor
2. Name of the Work as given in the Agreement
3. Agreement W O
4. Tender Amount
5. Date of Commencement of Work
6. Period allowed for Completion as per Agreement
7. Date of Completion as per Agreement
8. Period for which Extension of Time has been given

Date :Month : Year

1. 1st Extension vide Bank's Letter No
2. 3rd Extension vide Bank's Letter No
3. 3rd Extension vide Bank's Letter No

9. Reasons for which extensions have been previously given (Copies of the previous applications should be attached)

10. Period for which extension is applied for and the reasons thereof including hindrances, time for extra work assigned, if any etc.

Signature of Contractor & Seal

TECHNICAL SPECIFICATIONS (MAKES/MODELS)

S. No.	EQUIPMENT AND MATERIAL	ACCEPABLE MAKE
A.	**EQUIPMENT**	
1.	VRV System	Mitsubishi Electric/O-General/Toshiba
2.	Hi-wall Split Units	Mitsubishi Electric/O-General/Toshiba
3.	Motor	ABB/ Siemens/crompton
4.	DX TF AHU	Zeco/Edgetech/
5.	Axial Flow Fans	Kruger/ Humidin/Nicotra
6.	Extract Air Fan sections (EFS) / Fan Filter Units (FFUs)	Zeco/Ecoair/Balance Air
7.	V-Belts	Fenner India/ Dunlop
8.	Inline Fans	Sphere Vent/ Tristar
9.	Propeller Fans	Alstom Marathan
10.	Vibration isolators/suspenders	Resistoflex
11.	Steel Wire Rope Hangers & Supports	Gripple
12.	Drain Pumps	Aspen
13.	Ionizers	Intelligreen/ Rydair
14.	ESP Filters	Magneto/Honeywell/Rydair
B.	**PIPING**	
1.	Pipes (MS & GI)	Tata Steel/ Jindal (Hissar)
2.	PVC Piping	Poly Pack/Astral/Supreme
2.	Copper Refrigerant Piping	Mexflow/Mandev/RR
3.	Copper Refrigerant Piping Insulation (Closed Cell Elastomeric Insulation)	A Flex/K Flex/ Supreme
C.	**DUCTWORK AND AIR TERMINALS**	
1.	GS Sheet	SAIL/Tata Steel/National/Jindal/Lloyd

S. No.	EQUIPMENT AND MATERIAL	ACCEPABLE MAKE
2.	Factory Fabricated Ducts & TDC flanges	Ductofab/Zeco/GP Spira/Projtech
3.	Round/Spiral Factory Fabricated Ducts	Ductofab/Zeco/GP Spira/ Projtech
4.	Pre Filters	Purolator/Thermodyne/Spectrum
5.	Extruded Aluminium Grilles & Diffusers	Tristar/ Cynor/Ecoair/ Careair
6.	Dash Fasteners	HILTI/Fischer
7.	Intake Louvers	Tristar/ Cynor/Ecoair / Careair
8.	Duct /grille dampers & Air Transfer Grille	Tristar/ Cynor/Ecoair/ Careair
9	Flexible Ducts	Sphere/ Atco/UP Twiga
D.	**INSULATION**	
2.	Closed Cell Elastomeric Insulation	A Flex/K Flex/ Supreme
3.	Open cell nitrile rubber	A Flex/K Flex/ Supreme
4.	Expanded Polystyrene	Beardsell/ Toshiba/SHI

NOTE: Above makes of equipment are approved subject to their meeting the specifications. The contractor however shall seek approval of specific make from Consultant/ Bank's Engineer before commencing the work. The decision of Consultant/ Bank's Engineer shall & binding on the contractor in this respect. Any other make of the equipment not specified shall be got approved by the Bank's Electrical engineer in charge as per requirement.

PRO-FORMA OF HINDRANCE REGISTER

Name of Work:- Date of Start of Work:-

NameofContractor:- Period ofCompletion:-

AgreementNo.:- Date ofCompletion:-

Sr. No.	Nature of Hindrance	Date of Occurrence of Hindrance	Date of Which Hindrance was removed	Period of Hindrance	Signature Architect / Bank	Remarks
1	2	3	4	5	6	7

BILL OF QUANTITY

PREAMBLE:

To be read along with drawings.

1. Rates to be quoted both in figures and words.
2. All pages to be signed and stamped by the tenderer.
3. The rate of the items shall be applicable for any floor level/ any number of floors, or any quantity.
4. The specification of the items shall be as per latest Indian standard codes unless otherwise specified.
5. All materials shall be as per approved list and should be of 1st quality unless otherwise specified.
6. The rates are inclusive of all duties and taxes (except GST) of all government, municipal or any other statutory body applicable from time to time.
7. Rates shall be for items complete in all respects as per drawing, instructions and approval of the / bank's engineer.
8. The quantities are approximate and tentative which may vary during course of execution. The rates quoted against particular item shall not be changed with variation in quantities.
9. Making of any cutout / opening for electrical / air – conditioning wiring / fitting in any of the item of false ceiling, partitions, paneling masonry work etc. And finishing edges jambs / sills / soffits of the opening shall not be paid extra.
10. The tenderer shall visit the site and shall satisfy himself as to conditions under which the work is to be performed. He shall also check, ascertain the locations of any existing structures or equipment or any other situation which may affect the work. No extra claim as a consequence of ignorance or on ground of insufficient description will be allowed at a later date.
11. The quoted price for items shall include all accessories, consumables etc. As required to make the item complete in all respects, compatible with other related / associated items and fully functional.
12. Contractor shall be fully responsible for any error, difficulty in execution / damages incurred owing to discrepancy in drawings which has been overlooked by him and has not been brought to the notice of the .
13. There are number of items given in the tender where in basic rates including all taxes expected has been mentioned in the tender. These items shall be purchased by the contractor from the market only after the approval of quality and rates by the .
14. All hidden surfaces of board / ply / wood work to be painted with anti bacterial paint from nav air international fr 881 (viper) (white colour as per manufacturer's specifications on wood / board).
15. Contractor shall appoint technically qualified full time site supervisor to monitoring the day to day progress of work at site on their own cost

SPECIAL CONDITIONS OF CONTRACT FOR HVAC WORK

1. **Design Drawings**

The drawings prepared by the Consultants are indicative only of the general arrangement of the entire installation. The Contractor shall follow these drawings and specifications in preparation of his shop drawings and subsequent installation. He shall check the drawings of other trades to verify space for his installation. The Contractor shall examine all relevant architectural, structural, plumbing, electrical and other services layout drawings before preparing the shop drawings for this installation, and report to the Architects/Consultants any discrepancy and obtain clarifications. Any changes found necessary for co-ordination and installation of this work with other services and trades shall be made with prior approval of the Architects/Consultants and Owner without any additional cost to the Owner.

2. **Site visit & Shop Drawings**

The contractor shall visit the site and shall satisfy himself as to condition under which work is to be performed. No claim for consequences of ignorance at the later date shall be entertained. He should also check and ascertain the location of existing structure or equipment or any other situation which may effect the work.

The contractor shall submit five sets of shop drawings for air distribution system layout, Electrical panels & Equipment Layout drawings for approval of the Owners/Architects. Contractor shall also submit technical submittals for all major items including VRF system, Inline fans, piping, Ducting & GS sheet, grilles, diffusers, fire dampers, insulation material, electrical components etc. for the approval of the Owners/Architects.

Five sets of detailed shop drawings of all equipment and materials including ducting, piping, ventilation system, electrical work associated with the HVAC system required to complete the project as per specifications and as required by the Architect/ Consultant. These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all equipment, also the details of all related items of work by other Contractors. Each item of equipment proposed shall be a standard catalogue product of an established manufacturer as per specifications.

If the Architect/Consultants makes any amendment in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were made. After final approval has been obtained from the Architect/Consultant, the Contractor shall submit a further six sets of shop drawings for the exclusive use of and retention by the Architect/Consultant. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawings for the particular material or equipment.

The shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material to allow Architects/ Consultants ample time for scrutiny. No

claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved CPM charts.

Samples, drawings, specifications, catalogues, pamphlets and other documents submitted for approval shall be in quadruplicate, each item in each set shall be properly labeled, indicating the specific service for which material or equipment is to be used, giving reference to the governing section and clause number of Specifications clearly identifying in ink the items and the operating characteristics. Data of a general nature shall not be accepted.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail nor does it any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract.

Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required thereof, shall be prepared by the Contractor at his own cost and approved by the Architect/Consultant.

Where the work of the Contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make satisfactory adjustments. If so directed by the Architect/Consultant, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

Within two weeks of approval of all the relevant shop drawings, the Contractor shall submit to the Architect/Consultant four copies of comprehensive itemized price list of recommended imported and local spare parts and tools covering all equipment and materials in this contract. The Owner shall make arrangements to procure these spare parts and tools.

3. **Material & Workmanship**

All material used in work shall be of the best quality, obtainable and of approved list of manufacturers and shall conform to latest Indian Standard specifications unless otherwise stated.

4. **Erection and Supervision**

The Contractor shall depute engineers from time to time of commencement of installation work to inspect all relevant foundation/fabrication and other necessary facilities to make improved action if felt necessary. However, a qualified experienced engineer to be deputed at site beginning from commencement of HVAC activities at site & till handing over of the project.

5. **Testing and Commissioning**

On completion, the installation shall be tested for conformity with the stipulated performance specifications. Any defect, shortcoming detected in the system/material/workmanship shall be rectified by the Contractor to the entire satisfaction of the Consultants without any extra cost to the Owner. The installation shall be tested again after the removal of the defects and shall be commissioned only after approval by competent inspecting authority or the Consultants and the Owner. All tests shall be carried out in the presence of the Consultants and Owner's representative.

Testing and commissioning shall include furnishing all labour, materials, instruments etc. and incidentals necessary for complete testing of each component as per the specifications and manufacturer's recommendations.

Maintenance Services for the complete HVAC installation shall be provided during the defects liability period of one year.

The initial tests shall include but not be limited to the following:

i. To operate & check the proper functioning of all electrically operated components like compressor motor, pumps, blowers, fans and other electrical motors etc.

ii. To test and check the switchgears etc. and other safety & control devices ensuring proper functioning.

iii. To check and balance the water flow in the water circuits so that flow rate through various equipments is as per design.

iv. To check for leaks in the system & perform pressure testing.

v. To check alignment of motors, Belts and other dynamic equipments.

vi. To check all control settings to ensure smooth & proper functioning of the system.

6. **Samples & Technical Submittals**

Samples, make or brand of all the materials must be got approved by the Architect/ Consultants/Owner in writing before they are brought to the site. Nothing extra shall be paid for presenting samples of any item as desired by Owner/Architect/Consultants.

Technical submittals of all the major items or as desired by the Architects/Consultants incorporating complete technical details in line with the tender specifications & catalogue prior to procurement of equipment/material shall be submitted for the approval.

7. **Contradiction between BOQ, Specifications and Drawings :**

In the event of conflicts between BOQ, Specifications and Drawings, the BOQ shall take precedence over the specifications and drawings. Keeping the general intent of the scope of work under said contract, the Architects/Consultants would interpret the requirements of the design intent & contract and their decision shall be final and acceptable to all concerns including the contractors.

8 The equipments erected, commissioned at site should be suitable for maximum temperature of 50 degree C.

9. The electrical installation shall be carried out in accordance with Indian electricity rules, relevant Indian standard such as IS 732, IS 3043 and the requirements stipulated by local statutory body such as electrical inspectors for such installations. It is to be clearly understood that the final responsibility for sufficiency, adequacy, and conformity to the performance of the HVAC system shall be with the Contractor.

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TECHNICAL SPECIFICATIONS

A. "SPECIFICATIONS- MAIN EQUIPMENT"

1. VARIABLE REFRIGERANT FLOW SYSTEM

Scope

The scope shall be supply, installation, testing and commissioning of air cooled variable refrigerant Flow (VRF) system conforming to these specifications and meeting all design parameters as mentioned in the " Bill of Quantities" and drawings. Variable Refrigerant Flow System shall be a standard product, however all these specifications shall fully comply.

Type

Unit shall be heat pump type consisting of outdoor units and multiple indoor units, each suitable to facilitate cooling during summer & monsoon and heating in winter as per the requirements.

It shall be possible to connect minimum 10 indoor units on one refrigerant circuit. The indoor units on any circuit can be of different type and also controlled individually.

Compressor installed in outdoor units shall be equipped with all inverter compressors up to 20 HP and in bigger machines for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

Outdoor unit shall be suitable for mix match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor unit shall be possible to extend up to 165M with maximum 50M level difference **without any oil traps.**

Both indoor units and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant gas before delivering at site.

Units shall be factory finished with paint as per manufacturer's standard . However, shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.

Capacity

The refrigeration capacity of VRF outdoor and indoor units shall be as mentioned in the "Bill of Quantities" and as reflected on the drawings.

Outdoor Unit

The unit shall be heat pump type with automatic changeover in different seasons.

The outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing constructed from rust-proofed heavy gauge mild steel panels coated with a baked enamel finish. The unit should be completely factory wired, tested with all necessary controls.

All outdoor units shall have minimum two scroll compressors and be able to operate even in case of breakdown of one compressor. In case of outdoor units above 20HP, the outdoor unit shall have multiple inverter compressors so that the operation is not disrupted with failure of any compressor and if one compressor malfunctions, other continues to provide emergency operation smoothly till repair is effected. The unit shall be provided with duty cycling arrangement for multiple inverter compressors to facilitate sequenced operation of the machine for better stability and prolonged life.

The outdoor unit shall be modular in design and should be allowed for side by side installation. The unit shall be provided with its own microprocessors control panel.

The outdoor unit should have anti-corrosion paint free steel plate for easy mounting of unit.

The machine must have sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.

The outdoor unit should be fitted with low noise, aero spiral design fan with grill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor for better efficiency. The noise level shall not be more than 60dB (A) at normal operation measured horizontally 1M away and 1.5M above ground. For Residential application or wherever night operation is required the unit shall be suitable to operate on nighttime quiet operation mode having minimum three step of operation sound level i.e. 55dB to 45dB. Wherever required or as shown on the drawings the unit shall be selected for high external static pressure (ESP) not less than 78Pa (8mm WG) to meet long exhaust duct connection requirement.

The outdoor unit shall be designed to operate safely when connected to multiple fan coil units. The unit

shall be suitable to operate on environment friendly R 410A refrigerant.

<u>Compressor</u>

The compressor shall be highly efficient, high COP scroll type and capable of inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement.

All outdoor unit shall have multi-steps of capacity control to meet load fluctuation and indoor unit individual control. All parts compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.

Oil heater shall be provided in the compressor casing.

Inverter compressor shall preferably by Reluctance DC inverter compressor for higher efficiency and improved reliability.

Heat Exchanger

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil. The aluminum fins shall be covered by anti-corrosion resin film. The unit should be with e-pass heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser. The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

Refrigerant Circuit

The refrigerant circuit shall include an accumulator, liquid and gas shut off valves and a solenoid valves at condenser end. The equipment must have in built refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safety operation of the system.

Safety Devices

VRF system shall be provided with all safety devices as required and to ensure safe operation of the system, but not restricted to the following :

a. High pressure switch.
b. Low pressure switch.
c. Fuse.
d. Fan drive overload protector.
e. Fusible plug
f. Overload relay.
g. Overload protection for inverter.
h. Fan motor safety thermostat

Oil Recovery System

Each unit shall be equipped, with an oil recovery system to ensure stable operation with long refrigerant piping.

The system must be provided with oil balancing circuit to avoid poor lubrication. Anti-corrosion Treatment

Outdoor units should be designed with anti-corrosion specifications as detailed below for use in area, which are subject to salt damage and atmospheric pollution as specified in the BOQ.

The portion of machines like side panel, outer panel, bottom frame, which are exposed to corrosive atmosphere, should be of alloyed hot-dip zinc coated steel plate, coated with corrosion protection powder polyester resin coating on both inner and outer surfaces in thickness of 64 micron or more.

Finned coil protection net should have coating of resin coating containing ultraviolet ray absorbent. Fan and its fan protective net should be with weather resistant polypropylene resin.

The copper pipe –aluminium fins shall be special acrylic resin coated and internal supports, frame, control box shall also be hot-dip zinc coated steel plate and with rust preventive powder coating of 64 micron or more on inner and outer surfaces.

All screws and bolts used in outdoor unit shall be provided with SUS410, Zinc-nickel alloy plating, zinc chrome acid film treatment and rust inhibitor coating.

Indoor Units

This section deals with supply, installation, testing, commissioning of various type of indoor units confirming to general specification and suitable for the duty selected. The type capacity and size of indoor units shall be as specified in detail Bill of Quantities.

Indoor unit shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the rooms. The indoor units shall have following features :

a. The address of the indoor unit shall be set automatically in case of individual and group control.

b. In case of centralized control, it shall be set by liquid crystal remote controller.

c. The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

d. The cooling coil shall be made out of seamless copper tubes and have continues aluminium fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expended for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water.

e. Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall slide away type and neatly inserted.

f. Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling and heating.

g. Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

The indoor units shall generally be of following type : Ceiling

Mounted Ductable Type Unit

Each Indoor unit shall be ceiling mounted ducted type, as specified in scope of work. It shall have electronic control valve to control refrigerant flow rate in response to load variations of the room. The fan shall be of the dual suction multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation. The unit shall have high static fan for Ductable arrangement.

Ceiling Mounted Cassette Type Unit (Multi Flow/ Round Flow Type)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type. Noise level should not be more then 35 dB at low speed.

Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision (if specified) Low gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have **same decorative panel size** for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

Ceiling Suspended Type

Unit shall be suitable for ceiling suspended arrangement below false ceiling.
The units include pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel.

High Wall Mounted Units

The unit shall be wall mounted type. The unit includes pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel.

Unit shall have an attractive external casing for supply and return air.

Floor Standing Type

Unit shall be suitable for floor standing arrangement. The units include pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel.

Centralized Type Remote Controller

(Optional, if specified in BOQ)

A multifunctional compact centralized controller shall be provided with the system.

The controller must be necessarily a graphic Controller type to act as an advanced air- conditioning management system to give complete control of VRF air-conditioning Equipment, It should have case of use for the user and must have a user friendly colored touch screen, icon display and color LCD display.

a. It shall be able to control up to 64 groups of indoor units with the following functions :

b. Starting/stopping of Air-conditioners as a zone or group or individual unit.

c. Temperature settling for each indoor unit or zone.

d. Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.

e. Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.

f. Display of air conditioner operation history.

g. Daily management automation through yearly schedule function with possibility of various schedules.

h. The controller shall have wide screen user friendly color LCD (Liquid Crystal Display) and can be wired by a non polar 2 wire transmission cable to a distance of 1KM away from indoor unit.

Heat Reclaim Ventilation Unit.

In order to achieve the purpose of better indoor air quality, the Heat Reclaim ventilation (HRV) unit must exchange the heat between supplied fresh air and exhausted air in order to bring the outside air closer to indoor temperature and humidity conditions. Thus it must recover the thermal energy of exhaust air and reuse it for supplied fresh air. This must lead to ventilation without increasing the load and thus saving in running cost.

It shall be possible to interlock this HRV system with operation of VRF system to simplify installation and improving the efficiency of air-conditioning. It shall be possible to set automatic ventilation mode so that heat exchange mode and ventilation mode can be automatically selected to enhance energy conservation.

The casing of the HRV unit shall be made of galvanized steel plate, insulation with self extinguishable polyurethane foam. The HRV must have air filters of multi directional fibrous fleeces type.

The heat exchanger element must be designed without any moving parts for higher durability and reliability, It should have high permeability high efficiency specially processed paper which is flame retardant and fungi proof to keep air clean.

The unit must be provided with built in multi directional fibrous filter.

The unit must have optimized design of fan and air flow passage to make it compact and supply air & exhaust air passage must be arranged in such pattern so as to prevent mixing of supply (fresh) and exhaust air.

The unit must be suitable for single phase power supply and have their control panel.

2. **SPLIT UNITS**

Scope

The scope of this section comprises supply, installation, testing and commissioning of self contained air cooled split type air conditioning units each comprising of an outdoor and single/twin indoor units conforming to these specifications and in accordance with the requirement of drawings and schedule of quantities.

Outdoor Unit

Outdoor unit shall be an air cooled condensing unit suitable for out door installation conforming to the following specifications.

a. Unit Base & Casing

Base panel shall be constructed out of fabricated steel structure of adequate size. Casing panels shall be of 1.2 mm thick, welded construction, removable type to provide easy access to equipment and shall be bonderized and painted. Casing shall be complete with discharge outlets, grilles, space for refrigeration equipment, fans, condenser coil etc.

b. Compressor

i. Scroll Compressor

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermetic compressor with scroll plates, suction & discharge service valves. The compressor shall be complete with straight suction tube, centrifugal oil pump, oil charging valve, oil level sight glass, crank case heater and check valve on the scroll discharge port. The compressor shall be complete with the provision of two-point lubrication for each motor bearing. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

ii. Rotary Compressor

The rotary compressor shall be an industrial quality rugged, cast iron, hermatic/ semi hermatic compressor with capacity control side valve , oil sump heater & differential pressure refrigerant oil flow system. The compressor shall be provided with multiple pressure lubricated rolling element bearing group shall support the rotating assembly. Suitable overload protection shall be provided & necessary isolating valves shall be provided at suction & discharge . The compressor shall be fitted with electrically operated oil heaters with built in thermostats. The heaters shall be shall be automatically actuated when the compressor is stopped. Necessary time delay shall be provided for restart of compressor. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

c. Condenser

Condenser shall be air cooled in copper tube & aluminium fins construction. Condensers shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessory necessary with the equipment supplied.

d. Condenser Fan

Fan shall be preferably propeller type suitable for fractional horse power drive with IP-55 protection.

Indoor Unit

The indoor unit shall be basically a fan coil unit suitable for wall, floor and under ceiling installation of various types conforming to the following specifications.

a. Indoor units shall be either ceiling mounted cassette type, wall mounted type, floor mounted type or ceiling mounted ductable type in conformity with the design drawings and schedule of quantities.

Each indoor unit shall consist of PID controller for maintaining design room conditions besides microprocessor based thermostat for cooling. The indoor unit shall also be provided with wired

LCD type remote controller which shall memorize the latest malfunction code for ease in maintenance. The controller shall incorporate self diagnostic features. Such remote controllers associated with cassette type and hi-wall type indoor units shall incorporate inbuilt feature to be able to change fan speed and angle of swing flap individually as desired by the user.

The ceiling mounted cassette type indoor units shall comprise of an attractive moulded ABS plastic exterior enclosure provided with four way supply air grilles on the periphery and square return air grill at the centre with filter behind. Each cassette type indoor unit shall consist of high efficiency paddle type condensate water pump to facilitate forced disposal of condensate water and low gas detection system.

The hi-wall indoor units shall be suitable for installation on the wall preferably at lintel level. The specifications shall otherwise be similar to above.

Ceiling mounted ductable indoor units shall comprise of high static centrifugal fan, direct driven or belt driven through TEFC squirrel cage induction motor suitable for moderate amount of duct work. The housing shall be of light weight construction fabricated out of powder coated galvanized sheet steel single skin panels, internally insulated with 9mm thick closed cell elastomeric insulation material.

b. Cooling coil

Cooling coil shall be of the fin and tube type, having aluminium fins, firmly bonded to seamless copper tubes. Face and surface areas shall be such as to assure rated capacity and the air velocity across the coil shall not exceed 170 MPM. The coil shall be factory tested under water at 21 Kg/Sqcm air pressure.

c. Fan Section

The fan associated with non ductable indoor units shall be dual suction, aero dynamically designed, multi blade type, statically-dynamically balanced to ensure smooth circulation of air exhibiting lower noise level. The fan shall be direct driven type mounted directly on motor shaft supported from the housing.

Fan associated with ductable indoor unit shall be centrifugal double inlet double width forward curved type, preferably with variable pitch pulleys. The fan housing shall be statically-dynamically balanced at works to ensure noise and vibration free operation.

d. Filters

Filters shall be cleanable, synthetic fibre media of approved make. Velocity through filters shall not exceed 105 MPM and pressure drop across filters shall not exceed 5 mm of WG.

e. Insulation

All indoor unit shall be factory insulated with minimum 9 mm thick closed cell elastomeric insulation material towards thermal/acoustic treatment.

Drain pan shall be insulated with minimum 9mm mm thick closed cell elastomeric insulation material. Fixing of coil section and drain pan shall be done in such a way to avoid direct metal contact with any other un-insulated metal part in order to avoid condensation.

Condensate drain piping around the indoor unit shall also be insulated with minimum 9mm thick closed cell elastomeric insulation preferably in tubing form.

f. **Refrigerant Piping for Conventional Split Units**

The copper refrigerant piping shall be carried out neatly to connect outdoor and indoor unit/s and shall run along with wires/cables. The refrigerant piping associated with ductable units shall be carried out using hard drawn copper pipes & ready made copper fittings for pipe diameter exceeding 19mm. Piping less than 19mm shall be carried out using soft seamless copper pipes. Joints shall be affected by soldering/brazing process using silver rods. Suitable sleeves shall be provided at all wall crossings as required. The refrigerant circuit shall include liquid line and gas shut-off valves at the end of condenser.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 21Kg/ Sqcm. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum equivalent to 700mm Hg and held for another 24 hours prior to commencement of gas charging.

All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building element by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

The liquid and suction refrigerant lines including all fittings, valves, strainer etc. shall be insulated with 13 mm thick closed cell elastomeric insulation material preferably in tubing form as specified in Schedule of Quantities.

To protect nitrile rubber insulation associated with exposed copper piping from degrading due to ultra violet rays & atmospheric conditions, it shall be covered with polyshield coating. Fiberglass tape shall be helically wrapped & applied with two coats of resin with hardener to give smooth finish.

g. Electrical Installation

Factory fabricated local control panel shall be provided with each three phase ductable unit. The armoured conductor power cabling along with earthing shall be carried out as required and the cables shall be as per the “Approved Makes”.

3. **SUPPLY AIR FAN (FOR FRESH AIR)/EXTRACT FAN SECTION – DOUBLE SKIN TYPE**

Scope

The scope shall be supply, installation, testing and commissioning of packaged type supply air fan meeting all design parameters as mentioned in the "Bill of Quantities".

Material of Construction & Design

The housing shall be so constructed that it can be delivered at site in total/SKD conditions depending upon the requirement.

Inner panels shall be constructed out of 24 gauge (0.63mm) plain galvanized sheet and outer panels shall also be made out of 24 gauge (0.63mm) pre painted galvanized steel sheet. Width of each panel shall not exceed 750mm. Insulation shall be injected polyurethane foam in between the double skin panels of thickness as mentioned in the BOQ. These panels shall be bolted from inside on to the frame work with soft rubber gasket in between to make the joints air tight.

Unit framework shall be made out of extruded aluminium hollow sections filled with preformed insulation section. Frame work for each section shall be bolted together with soft rubber gasket in between to make the joints air tight. Frames shall be assembled using mechanical joints to make a sturdy and strong framework for various sections. Suitable doors with pressure die cast aluminium hinges and latches shall be provided for access to various panels for maintenance. The entire housing shall be mounted on steel channel frame work.

Pre -Filters Section with Filters

Filter section shall house the washable synthetic type air filters having anodized aluminium frame. The media shall be supported with HDP mesh on one side and aluminium mesh on other side. Filter face velocity shall not exceed 500 FPM. Filters shall fit so as to prevent by- pass. Holding frames shall be provided for installing a number of filter cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels. Pre filters shall conform the detailed specifications as elaborated in the preceding clause under sub head "Filters".

Centrifugal Fan & Motor

The fan shall be forward curved floor standing double inlet double width type. The wheel and housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy duty ball bearings. The fan shall be selected for speed not exceeding 1000 RPM. The impeller and fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 2000 FPM. Fan housing with motor shall be mounted on a common steel base mounted inside the air handling housing on anti-vibration spring mounts or rubber mounts. The fan outlet shall be connected to casing with the help of fire retardant canvass constructed out of imported fabrics.

Fans shall be driven by an electric motor as specified in the schedule of quantities. Motor ratings are only tentative and where a fan requires a higher capacity motor, the contractor shall

clearly point out the requirement and make his offer accordingly. Motor ratings shall be at least 10% over limit load plus transmission losses.

Fan motors shall be suitable for operation on 415 ±10% volts, 50 cycles, 3 phase, AC power supply and shall be TEFC squirrel cage induction type totally enclosed fan cooled with IP-55 protection. Motors shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall be of the oil-resistant type.

Note :

Construction of EXTRACT FAN SECTION shall generally be similar to supply air fan as elaborated above but without filters. For detail description of extract fan section please refer "Bill of Quantities".

4. FILTERS

4.1 Viscous Metallic Filters

Viscous metal filter shall be all metal, washable type. The filter media shall be composed of layers of crimped GI wire mesh. The velocity over face of filter shall not exceed 90 MPM. and pressure drop shall not exceed 5mm for 50mm thick filter. The filter shall be of GI and suitable for mounting as required at site.

4.2 Synthetic Fibre Filters

Synthetic fibre filter shall be cleanable in light weight aluminium framed with non-woven synthetic fibre replaceable media. The filter shall have an efficiency of 90% down to 10 microns when tested as per BS: 2831 standard. It shall be suitable for operation under 100% Relative Humidity & 120 degree C temperature conditions. The velocity over the face of filter shall not exceed 105 MPM and the pressure drop across the filter shall not exceed 2.5mm WG for 25mm thick filter. The filter frame shall be of aluminium and shall be suitable for mounting in air handling unit as required at site.

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B. **“SPECIFICATIONS - VENTILATION FANS"**

1. **CENTRIFUGAL FANS**

1.1 Centrifugal fans shall be of approved make DIDW or SISW of specified arrangement complete with inspection door, squirrel-cage induction motor, V belt drive, belt guard and vibration isolators etc. Type, direction of discharge / rotation, and motor position shall be as per the Approved for Construction shop drawings.

1.2 Fans, Aerofoil, forward or backward curved, SISW or DIDW 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”.

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

1.4 All fans shall be oven-baked with polyester coating for minimum thickness of 60 microns unless the housing scroll and side frame is constructed from galvanized steel sheet (GSS) .Fan should be of G.S.S., the Steel sheet should be JFE Galvazinc (Base metal cold rolled), JIS G3302, SGCC with Z22 (minimum coating weight on both sides @ 220 g/m2) zinc coating & Zero Spangle, skin passed, chromated and dry.

1.5 Fans housing shall be of an appropriate thickness to prevent vibration and drumming and in no case the housing shall be constructed less than 14 Gauge sheet steel and all parts shall be bonderized and then coated with primer finish of approved colour. The fan scroll shall be attached to the side plate by means of continuous lock seam or welded scam. 18 gauge galvanized wire mesh inlet guards of 5 cm sieves shall be provided on both inlets. Housing shall be provided with standard cleanout and door with quick locking tension handles and neoprene gasket. Rotation arrow shall be clearly marked on the housing.

The wheel and inlet cone shall be aerodynamically designed and constructed to provide maximum performance and efficiency as published by the manufacturer.

1.6 Fans must be physically capable of operating safely at every point of rating at or below the “minimum performance” limit for that class as defined in AMCA standard 99-2408-69 “Performance Class of Operating Limits for Centrifugal Fans”.

1.7 Shafts sizes shall be carefully calculated and designed such that the maximum operating speed (RPM) shall not exceed 75% of the first critical speed. For any application that is not a standard product from catalogue of the fan manufacturer detailed calculation of critical speed characteristic shall be submitted for approval.

1.8 Shafts shall be constructed out of carbon steel (C45) machined and polished to tolerance of standard ISO 286-2 - grade g6. Protective coat of anti-rusting shall be applied to all bare surfaces of the shafts at the factory.

1.9 Bearings shall be of self-alignment (concentric) type with adaptor sleeve bearing. Bearings of eccentric locking collar with grub screw type are not acceptable. Bearing shall be maintenance free with permanently lubricated sealed ball bearing type. Bearing life shall be at least 75,000 hours based on basic rating life, L10 of ISO 281 standard. Calculation sheet of Bearing Life shall be submitted for approval.

1.10 Motor installed shall be of a minimum 130% of the fan power absorbed (Brake horsepower) and shall have sufficient torque available for starting and continuous operation. Motor shall be suitable for 415 ± 10% volts, 50 Hz, 3 phase power supply.

1.11 Belts and pulleys shall be sized for a minimum 150% of the installed motor horsepower. The belt speed shall not exceed 30m/s. The pulley shall be of Taper Lock SPZ, SPA, SPB or SPC type. Conventional type of pulley is not acceptable. Both fan and motor pulley shall be balanced to the quality grade G.2.5.

1.12 Fan outlet velocity shall not exceed 2000 FPM (10.16 MPS) and maximum fan speed shall be 1000 RPM. Fan wheel and housing shall be statically and dynamically balanced. Necessary documents establishing Dynamic balancing carried out at factory shall be provided with the consignment.

1.13 Computer printout on fan performance rating corresponding to the AMCA licensed data, with corrected rating for altitude and temperature, fan operating speed, bearing life, etc. shall be submitted for approval.

1.14 For Air washer Application, fans should be provided with coat of Pure polyester powder coating. Fans should have Inspection door & Drain plug.

2. AXIAL FLOW FANS (DIRECT DRIVE)

2.1 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”.

2.2 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.

2.3 All fans shall be oven-baked with polyester coating for minimum thickness of 60 microns or hot dip galvanized or Casing shall be constructed out of heavy gauge sheet steel. Fan casing, motor mount and straightening vane shall be of welded steel construction. Motor mounting plate shall be minimum 20 mm thick and machined to receive motor flange. Casing shall be provided with wide hinged door which opens easily for removal of wheel,

shaft and bearings. A small inspection door with handle and neoprene gasket shall also be provided.

Casing shall have flanged connection on both ends for ducted applications.

Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed and finish coated with enamel paint.

2.4 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.

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

2.6 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.

2.7 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 dame clearance between blade tips and casing of the tested prototype. Note that the air performance and pressure loss are greatly affected by this clearance.

2.8 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.

2.9 Fan motor shall be totally enclosed and external terminal box of at least IP55 shall be provided. Motor efficiency shall be minimum confirming specifications as described in ECBC-2007. Motor shall be suitable for 415 $\pm$ 10% volts, 50 Hz, 3 phase power supply, provided with class B, class F or class H insulation as mentioned in the BOQ. Motor name plate horse power shall exceed brake horse power by a minimum of 10%. Motor shall be specially designed for quiet operation.

2.10 Fans speed shall not exceed 1500 RPM.

2.11 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.

2.12 The assembly of fan and motor shall be suspended from the ceiling by vibration isolation suspension of rubber in shear type of approved make or as recommended by the manufacture.

Accessories :

The following accessories shall be provided with all fans.

i. Outlet cone for static pressure regain.
ii. Inlet cone.

Fan silencers may be provided where specifically called for in Schedule of Quantities. Fans shall be factory assembled and shipped with all accessories factory mounted.

3. VANE AXIAL FLOW FANS (DIRECT DRIVE)

3.1 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".

3.2 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 with Fixed Guide Vanes.

3.3 Fan Casing should be provided with Special Designed Integral **Straightening Vanes** to reduced turbulence provide high performance & low noise level.

3.4 All fans shall be oven-baked with polyester coating for minimum thickness of 60 microns or hot dip galvanized or Casing shall be constructed out of heavy gauge sheet steel. Fan casing, motor mount and straightening vane shall be of welded steel construction. Motor mounting plate shall be minimum 20 mm thick and machined to receive motor flange. Casing shall be provided with wide hinged door which opens easily for removal of wheel, shaft and bearings. A small inspection door with handle and neoprene gasket shall also be provided.

Casing shall have flanged connection on both ends for ducted applications.

Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed and finish coated with enamel paint.

3.5 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. Motor shall be suitable for 415 ± 10% volts, 50 Hz, 3 phase power supply, provided with class B, class F or class H insulation as mentioned in the BOQ. Motor name plate horse power shall exceed brake horse power by a minimum of 10% . Motor shall be specially designed for quiet operation.

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

3.7 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.

3.8 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.

3.9 Fans speed shall not exceed 1500 RPM.

3.10 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.

The Fan should be AMCA Certified for Air & Sound Performance.

3.11 The assembly of fan and motor shall be suspended from the ceiling by vibration isolation suspension of rubber in shear type of approved make or as recommended by the manufacture.

4. SUPPLY AIR FAN (FOR FRESH AIR)/EXTRACT FAN SECTION – Double skin type

Scope

The scope shall be supply, installation, testing and commissioning of packaged type supply air fan meeting all design parameters as mentioned in the “Bill of Quantities”.

Material of Construction & Design

The housing shall be so constructed that it can be delivered at site in total/SKD conditions depending upon the requirement.

Inner panels shall be constructed out of 24 gauge (0.63mm) plain galvanized sheet and outer panels shall also be made out of 24 gauge (0.63mm) pre painted galvanized steel sheet. Width of each panel shall not exceed 750mm. Insulation shall be injected polyurethane foam in between the double skin panels of thickness as mentioned in the BOQ. These panels shall be

bolted from inside on to the frame work with soft rubber gasket in between to make the joints air tight.

Unit framework shall be made out of extruded aluminium hollow sections filled with preformed insulation section. Frame work for each section shall be bolted together with soft rubber gasket in between to make the joints air tight. Frames shall be assembled using mechanical joints to make a sturdy and strong framework for various sections. Suitable doors with pressure die cast aluminium hinges and latches shall be provided for access to various panels for maintenance. The entire housing shall be mounted on steel channel frame work.

Pre -Filters Section with Filters

Filter section shall house the washable synthetic type air filters having anodized aluminium frame. The media shall be supported with HDP mesh on one side and aluminium mesh on other side. Filter face velocity shall not exceed 500 FPM. Filters shall fit so as to prevent by-pass. Holding frames shall be provided for installing a number of filter cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels. Pre filters shall conform the detailed specifications as elaborated in the preceding clause under sub head "Filters".

Centrifugal Fan & Motor

The fan shall be forward curved floor standing double inlet double width type. The wheel and housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy duty ball bearings. The fan shall be selected for speed not exceeding 1000 RPM. The impeller and fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 2000 FPM. Fan housing with motor shall be mounted on a common steel base mounted inside the air handling housing on anti-vibration spring mounts or rubber mounts. The fan outlet shall be connected to casing with the help of fire retardant canvass constructed out of imported fabrics.

Fans shall be driven by an electric motor as specified in the schedule of quantities. Motor ratings are only tentative and where a fan requires a higher capacity motor, the contractor shall clearly point out the requirement and make his offer accordingly. Motor ratings shall be at least 10% over limit load plus transmission losses.

Fan motors shall be suitable for operation on 415 $\pm$10% volts, 50 cycles, 3 phase, AC power supply and shall be TEFC squirrel cage induction type totally enclosed fan cooled with IP-55 protection. Motors shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall be of the oil-resistant type.

Note :

Construction of EXTRACT FAN SECTION shall generally be similar to supply air fan as elaborated above but without filters. For detail description of extract fan section please refer "Bill of Quantities".

5. **Propeller Type Fans :**

The propeller type fans shall be used for exhaust air or for fresh air supply as shown on the drawings having following constructional features :

a. Fans shall be of ring mounted type having steel hub and MS blade, mounted directly on the shaft of a totally enclosed motor Bearings shall be maintenance free permanently lubricated type.

b. The fan blades shall be constructed out of pressed steel in aerofoil design to achieve high efficiency. The mounting frame shall be of cast/sheet steel with steel brackets to connect the frame with the fan/motor assembly.

c. Rubber mounts shall be provided between the mounting frame and the mounting brackets. The fan shall be direct driven type and motor shall either be capacitor start – run or three phase squirrel cage induction type totally enclosed.

d. The fan shall be fitted with gravity type louvers. The speed of fan shall be as mentioned in "Bill of Quantities" and drawings.

e. All the fans shall be tested for performance and the following test results shall be furnished :

i. Air flow rate in C.F.M.
ii. Static pressure at the fan supply end.

6. **Inline Fans :**

The inline fans shall be used for exhaust air or for fresh air supply as shown on the drawings having following constructional features :

a. The casing shall be constructed out of hot rolled heavy gauge GSS metal epoxy coated embodied with required inspection doors.

b. Fan shall be direct driven SISW forward or backward curved centrifugal type. Material of construction for impeller shall GSS. Fan wheel shall be statically and dynamically balanced.

c. The bearing shall be completely maintenance free and can be used in any mounting position, at maximum indicated temperature.

d. Motor shall be total enclosed external rotor type and suitable for operation on 415$\pm$10% volts,3phase or 220$\pm$6% volts,1 phase , 50Hz AC power supply.

e. Single phase inline fans shall be provided with factory fitted speed regulators and three phase inline fans shall be provided with GI dampers.

f. All the fans shall be tested for performance and the following test results shall be furnished :

i. Air flow rate in C.F.M.
ii. Static pressure at the fan supply end.

****

C. "SPECIFICATIONS - PIPING"

1. General :

a. The scope under this section covers supply, laying, erection, testing and commissioning of pipes, pipe fittings and associated valves conforming to these specifications and the general arrangements shown on the drawings.

b. All piping including pipe fittings and valves shall follow the relevant Indian Standards/manufacturer's recommendations.

2. Refrigerant Piping :

All refrigerant piping for the VRF air conditioning system shall be constructed out of hard drawn copper refrigerant pipes with copper fittings and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good engineering practice within the air-conditioning industry, and shall be inclusive of charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be sweet joints using low temperature brazing and or silver solder. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall bee thoroughly blown out using nitrogen.

The Refnet Joints (Y-joints) and Refnet Headers shall be made from copper and would be imported, factory fabricated and pre-insulated.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 35Kg/Sq. Cm and 10 Kg/Sq.Cm (low side). Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum of 700mm Hg and held for 24 hours.

The air-conditioning system supplier shall verify the refrigerant piping design conceived and brought to the notice of Consultants if any discrepancy is found.

The OD & wall thickness of copper refrigerant piping shall be as follows:

Outside Pipe Dia (mm)	Wall thickness (mm)
54.1	1.5
41.3	1.3
34.9	1.3
28.6	1.2
25.4	1.2
22.2	1.2

Outside Pipe Dia (mm)	Wall thickness (mm)
19.1	1.0
15.9	1.0
12.7	0.8
9.5	0.8
6.4	0.8

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm thick closed cell elastomeric insulation material.

The joints shall be properly sealed with synthetic glue to ensure proper bonding of the ends.

3. **Drain Piping:**

a. All pipes to be used for drain, condensate drain and fittings shall be galvanized steel class 'B' (medium class) confirming to relevant IS & BIS Codes.

b. All jointing in the pipe system shall be by screwed and / or by screwed flanges using 3mm 3 ply rubber insertion gaskets. Pipe threads and flanges shall be as per relevant BIS Codes.

c. All pipes supports shall be mild steel, thoroughly cleaned and given one primary coat of red oxide paint before being installed.

d. Fittings shall be galvanized steel "medium class" malleable casting of pressure rating suitable for the piping system. Flanges shall be of approved make. Supply of flanges shall include bolts, nuts, and gaskets as required. Sufficient number of flanges and unions shall be provided for future cleaning and servicing of piping. Tee-off connection shall be through equal or reducing Tees. All equipment and valve connections or connections to any other mating pipes shall be through flanges required for the mating connections.

All condensate drain piping shall be insulated with closed cell elastomeric insulation material of thickness as mentioned in "Schedule of Quantities".

4. **Insulation**

Drain Pipes shall be insulated as required or as shown on the approved drawings and in line with specifications stipulated in section 'INSULATION'.

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D. "SPECIFICATIONS - DUCTWORK AND AIR TERMINALS"

1. General:

a. The scope under this section covers supply, fabrication, installation and testing of all GS sheet metal ducts and supply, installation, testing and balancing of grilles, diffusers conforming to these specifications and the general arrangements shown on the tender drawings.

b. Duct work shall mean all ducts, dampers, access doors, joints, stiffeners, supports and hangers.

2. Duct Work Fabricated at Site as per BIS Standards

2.1 Duct Material and Fabrication

Material used for ducts shall be galvanized steel sheets class VIII conforming to IS:277- 1962(revised) or aluminium sheets conforming to IS:737-1955 as specified in the Bill of Quantities. All ducts shall be fabricated and installed in a workman like manner, generally conforming to IS : 655-1963 (Revised) with amendment-I(1971 edition).Fabrication of ducts shall be through well conditioned Triplex lock former or multiple lock formers, conforming to relevant BIS Codes. Round exposed ducts shall be die formed for achieving perfect circle configuration.

Thickness of the sheet shall be as given hereunder :

	Sheet thickness	
Size of Duct	**GSS**	**Aluminium**
Up to 750 mm	24 Gauge (0.63mm)	22 Gauge (0.80mm)
751 mm to 1500mm	22 Gauge (0.80mm)	20 Gauge (1.00mm)
1501 mm to 2250mm	20 Gauge (1.00mm)	18 Gauge (1.25mm)
2251 mm and above	18 Gauge (1.25mm)	16 Gauge (1.6mm)
All Round Ducts	20 Gauge (1.00mm)	--

Joints and bracing of ductwork shall generally be as per IS Specifications. However, minimum size of accessories involved shall be as given hereunder :

Size of Duct	**Joint Type**	**Bracing**
Up to 750 mm	G.I. Flange	--

751 mm to 1000 mm	25 mm x 25 mm x 3 mm angle iron frame with 8 mm dia nuts and bolts.	25 mm x 25 mm x 3 mm angle iron frame at 1000 mm centre
1001 mm to 1500 mm	40 mm x 40 mm x 5 mm angle iron frame with 8 mm dia nuts and bolts.	40 mm x 40 mm x3 mm angle iron frame at 1000 mm centre
1001 mm to 1500 mm	40 mm x 40 mm x 5 mm angle iron frame with 8 mm dia nuts and bolts.	40 mm x 40 mm x 3 mm angle iron frame at 1000 mm centre
1501 mm to 2250 mm	50 mm x 50 mm x 5 mm angle iron frame with 12 mm dia nuts and bolts. at 125 mm centre.	40 mm x 40 mm x 3mm angle iron frame at 1200 mm centre (diagonally cross braced)
2251 mm and above	50 mm x 50 mm x 6 mm angle iron frame with 12 mm dia nuts and bolts. at 125 mm centre.	40 mm x 40 mm x 3 mm angle iron frame at 1200 mm centre (diagonally cross braced)

2.1.2 GI sheets shall be produced using hot deep galvanization process and minimum acceptable coating of zinc shall be 120gm/SqM. Sample of GI sheet along with test certificate to be submitted for approval prior to supply of GI sheets.

2.1.3 GI sheets shall be checked for hardness/flexibility and water marks prior to dispatch. Zinc coating if found peeled –off or duct work with water marks after fabrication shall be rejected..

2.1.4 Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.

2.1.5 All exposed ducts within conditioned spaces shall have only slip joints and no flanged joints. The internal ends of slip joints shall be made in the direction of air flow.

2.1.6 Change in dimensions and shape of ducts shall be gradual. Curved elbows, unless otherwise approved, shall have a centre line radius equal to one and half times the width of the duct. Air turns shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes, arranged to permit the air to make the turns without appreciable turbulence.

2.1.7 GI splitter dampers complete with brass metal lever shall be installed at each bifurcation / trifurcation point of duct for proper flow of air quantity in each duct.

2.1.8 Ductwork shall be fabricated strictly in accordance with the “Approved for Construction” Shop drawings. All ducts shall be rigid and shall be adequately supported and braced where

required with standing seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

2.1.9 All sheet metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans, shall be constructed out of 18 gauge galvanized steel sheet, thoroughly stiffened with angle iron braces mentioned above and fitted with all necessary doors as required by the Consultants, to give access to all parts of the apparatus. Doors shall not be less than 45cm x 45cm in size. All hardware fittings such as thunder bolts, hinges, handles etc shall be in extruded aluminium construction.

2.2 Installation of Ductwork

2.2.1 During construction, the contractor shall temporarily close the duct openings with sheet metal covers to prevent debris and any foreign material entering ducts and to maintain opening straight and square.

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

2.2.3. 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. This work shall meet with the approval of the Architects/Owners in all its parts and details.

2.2.4. All ducts shall be supported from the ceiling /slab using 9mm to 12mm dia MS rods depending upon the size of the duct unless & until mentioned otherwise in the BOQ. MS angle iron of size not less than 40mmx40mmx5mm or more if duct size is large enough shall be used at the bottom. The MS rods shall be anchored to RCC slab using suitable metallic expansion fasteners.

2.2.5 All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the buildings, whether or not the same are shown on the drawings. Where it becomes 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 as approved or directed by the Architects/Consulting Engineer.

2.2.6 If a duct cannot be run as shown on the drawing, the contractor shall install the duct between the required points by any path available, subject to the approval of the Architect/ Consultant.

2.2.7 All duct work shall be independently supported from building elements or as required by the Architect/ Consultant. All horizontal ducts shall be rigidly and securely supported, in an approved manner, within hangers formed of MS rods and angle iron under ducts not greater than 2 M centers. All vertical duct work shall be supported by structural members at each floor.

2.2.8 Ducting on top of the ceiling shall be supported from the slab above, or from beams with the help of adequate strength dash fasteners, after obtaining approval of the

Architect/ Consultant. In no case shall a duct be supported from the ceiling hangers or be permitted to rest on a hung ceiling.

2.2.9 All metal work in dead or closed down spaces shall be erected in time to occasion no delay to other contractors in the building.

2.2.10 All air turns of 45 degrees or more shall include curved metal blades or vanes so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All supply air collars shall be provided with GI vanes properly secured using rivets.

2.2.11 All ducts shall be totally free from vibration under all conditions of operations. Whenever duct work is connected to fans, that may cause vibrations in the duct, ducts shall be provided with two flexible connections located close to the unit in mutually perpendicular directions. Flexible connection shall be constructed of fire resistant flexible double canvas sleeves at least 150mm long, secured properly and bolted at both ends. 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.

2.2.12 The two mating flanges of the ducts being joined with each other shall be made air tight by providing 4mm thick rubber gasket fixed on both mating flanges by means of good quality adhesive. Rubber strip shall also be provided between bottom surface of duct and angle iron at each duct support to avoid metal to metal contact.

2.2.13 All duct supports including MS rods, cleats and angle iron shall be primer coated and thereafter, painted with black enamel paint.

2.3 <u>Round Ductwork</u>

Spiral/round ductwork wherever required shall meet following parameters :

a. Conform to BIS round ductwork requirements.

b. Round Ducts shall be constructed out of galvanized sheet steel as per relevant BIS standards.

c. Upto 1200mm dia ducts spiral lock seam shall be provided.

d. Ducts more than 1200 mm diameter shall be provided with welded longitudinal or spiral seam.

e. Lap or snap lock seams are not permitted for round ductwork of any size.

f. Provide beaded sleeve or flanged and gasketed joints for ducts.

g. Provide all welded long radius elbows.

h. Provide conical tees, all welded.

i. Butt tees or butt taps are not permitted.

All round ducts, 750 mm and larger, shall be supported with two hangers at each support point in an approved manner.

3. Duct Work Fabricated in Factory as per SMACNA Standards

3.1 Duct Material and Fabrication

Material used for ducts shall be galvanized steel sheets class VIII, light coating of zinc, nominal 120gm/SqM surface area conforming to IS:277-1962 (revised) or aluminium sheets conforming to IS:737-1955 as specified in the Bill of Quantities. GI sheet shall be of Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by Client's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

3.2. Recommended Thickness and Type of Joints

All ducts shall be fabricated using galvanized steel/aluminum sheet with thickness as mentioned hereunder :

3.2.1 For Ducts with External Static Pressure (SP) upto 250 Pa (25mm) :

GSS Rectangular Ducts	**Pressure 250 Pa (25mm)**		
	Duct Section Length 1.2 m (4 ft)		
Maximum Duct Size	**Gauge as per BOQ**	**Joint Type**	**Bracing Spacing**
1–750 mm	26 or 24	**"4 Bolt Transverse Duct Connector-E (TDC) with built in sealant" as per BOQ .**	Nil
751 – 899 mm	24	4 Bolt Transverse Duct Connector-E (TDC) with built in sealant	Nil
900 – 1200 mm	24 or 22	4 Bolt TDC –E	Nil
1201 – 1500 mm	22	4 Bolt TDC-H	Nil
1501 – 1800 mm	22 or 20	4 Bolt TDC-H	Nil
1801 – 2100 mm	20	4 Bolt TDC-J	Nil
2101 – 2700 mm	18	4 Bolt TDC-J	Nil

3.2.2 For Ducts with External Static Pressure (SP) upto 500 Pa (50mm) :

GSS Rectangular Ducts	**External Pressure 500 Pa (50mm)**		
	Duct Section Length 1.2 m (4 ft)		
Maximum Duct Size	**Gauge**	**Joint Type**	**Bracing Spacing**
1–600 mm	24	**"4 Bolt Transverse Duct Connector-E (TDC) with built in sealant" as per BOQ .**	Nil
601-700 mm	24	4 Bolt Transverse Duct Connector-E (TDC) with built in sealant	Nil
701-900 mm	24 or 22	4 Bolt TDC-E	Nil
901-1200 mm	22 or 20	4 Bolt TDC-H	Nil
1201-1300 mm	20	4 Bolt TDC-J	Nil
1301-1500 mm	18	4 Bolt TDC-J	Nil
1501-1800 mm	18	4 Bolt TDC-J	Nil
1801-2100 mm	18	4 Bolt TDC-J	Nil
2101-2250 mm	18	4 Bolt TDC-J	Nil
2251-2400 mm	18	4 Bolt TDC-J	Nil
2401-2700 mm	18	4 Bolt TDC-J	600 *

'C'-cleat; 'S'-S cleat; 'SS'-Standing S cleat; 'AI' -Angle Iron in mm
* Distance of reinforcement/bracing from each joint. Bracing material to be same as of material used for joining of duct sections.

For Aluminium ducts material shall be one commercial gauge higher with 22 gauge as minimum.

3.3 Fabrication Standards and Equipment

All duct construction and installation shall be in accordance with SMACNA standards. In addition ducts shall be factory fabricated utilizing the following machines to provide the requisite quality of ducts.

3.3.1 Coil (Sheet metal in Roll Form) lines to facilitate location of longitudinal seams at corners/folded edges only, for required duct rigidity and leakage free characteristics. No longitudinal seams permitted along any face side of the duct.

3.3.2 All ducts, transformation pieces and fittings to be made on CNC profile cutter for requisite accuracy of dimensions, location and dimensions of notches at the folding lines.

3.3.3 All edges to be machine treated using lock formers, flangers and rollers for turning up edges.

3.4 Duct Construction

All ducts shall be fabricated and installed in workmanlike manner, conforming to relevant SMACNA codes.

a) Ducts so identified on the Drawings shall be acoustically lined and insulated from outside 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. The fabricated duct dimensions should be as per approved drawings and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gaps.

b) Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or snap button as per SMACNA practice, to ensure air tightness.

c) All concealed ducts up to 750mm width within conditioned spaces shall have slip and drive (C & S/SS) joints. The internal ends of slip joints shall be in the direction of airflow. Care should be taken to ensure that S/SS Cleats are mounted on the longer side of the duct and Cleats on the shorter side. 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 (between 1:4 and 1:7). Air-turns (vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

e) Ducts shall be fabricated as per details shown on Approved for Construction Shop Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

f) All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans, shall be constructed of 18 gauge GSS / 16gauge aluminum, thoroughly stiffened with 25mm x 25mm x 3mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Access doors shall be not less than 450mm x 450mm in size.

g) Plenums shall be shop/factory fabricated panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards GS sheet and riveting shall be done from outside.

h) Self adhesive Neoprene rubber / UV resistant PVC foam lining 5mm nominal thickness instead of felt, shall be used between duct flanges and between duct supports in all ducting installation

3.5 Duct Installation

All ducts shall be installed generally as per tender Drawings, and in strict accordance with approved shop drawings to be prepared by the Contractor. The contractor shall also carry out the feasibility study at site, coordination with other services and interior drawings before fabrication of duct at the factory. Any fabricated duct rejected due to these reasons shall not be paid and only final measured and installed duct shall be certified for payment.

a. 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 Architects/Consultants/Client's site representative in all its parts and details.

b. 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 conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

c. 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 Client's site representative. Fabrication of duct shall be commenced only after verifying the feasibility at site.

d. All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of fully threaded galvanized steel rods and galvanized steel angle/channel under ducts at no greater than 2 meter centre. All vertical duct work shall be supported by structural members on each floor slab. Galvanised steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/ channels shall be hung through these cleats. Duct support shall be through dash /anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats. Size of supports shall be as given hereunder :

Larger Size of Duct	"C" channel size	Fully threaded GI Vertical Rod size	Maximum spacing between supports

Up to 600mm	40mmx40mmx18gauge	8mm	2000mm
601mm to 1200mm	40mmx40mmx16gauge	10mm	2000mm
1201mm to 1800mm	50mmx50mmx5mm MS angle iron duly painted	12mm	2000mm
1801mm & above	65mmx65mmx6mm MS angle iron duly painetd	12mm	2000mm

e. Ducting over false ceiling shall be supported from the slab above, or from beams, after obtaining approval of Client's site representative/Architects. 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 Contractor's work in the building. All supports of ducts shall be taken from structural slab/wall by means of fastener.

f. Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality expanded polystyrene around the duct and totally covered with mortar for complete sealing. Contractor shall ensure that contact between metal duct and mortar is avoided.

g. 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 vibration in the ducts, ducts shall be provided with a fire resistant double flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 100mm 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 sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.

h. In case of grid type false ceiling, the entire diffuser assembly with plenum shall be independently hung from the ceiling through adjustable GI wires and the same shall be connected to the main duct through a flexible round duct.

i. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

j. Suitable arrangement shall be provided in duct for fixing of duct smoke sensor (supplied by other vendor).

k. Toilet exhaust duct shall be provided with goose necking as shown in design drawings and exhaust shall continue operation in case of fire.

Duct Support with Steel Wire Rope Hangers

Wire Hangers with following specifications shall be used to suspend static HVAC Air Distribution services as required.

Wire Hangers should consist of a pre-formed wire rope sling with a range of end fixings to fit various substrates and service fixings, these include a ferruled loop, permanently fixed threaded M6 (or M8, M10) stud, permanently fixed nipple end with toggle, at one end or hook or eyelet, cladding hook, barrel, wedge anchor, eyebolt anchor or any other end fixture type or size as per manufacturers recommendation and design. The end fixings and the wire must be of the same manufacturer with several options available. The system should be secured and tensioned with a Hanger self-locking grip at the other end. Once the grip is locked for safety purpose unlocking should only be done by using a separate setting key and should not be an integral part of the self-locking grip. Only wire and/or supports supplied and/or approved, shall be used with the system.

a. Wire Hangers should have been independently tested by Lloyds Register. APAVE, TUV, UL, CSA, Chiltern International fire, ADCAS, Intertek, ECA, and SMACNA, approved by ULC and CSA and comply with the requirements of DW/144 and BSRIA – wire Rope Suspension systems. Wire rope should be manufactured to BSEN 12385: 2002

b. The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum safe working load limit (which incorporates a 5:1 safety factor).

The correct specification of wire hanger required is determined using the following formula.

Weight per meter of object suspended (kg) x Distance between suspension points (m) = weight loading per Hanger suspension point (kg).

Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the manufacturer's recommendations.

The contractor shall select the correct length of wire rope required to support the service. Lengths from 1-10m lengths. Specials can be made, check with manufacturer. No in–line joints should be made in the rope.

Wire (Gripple) Hanger Safe Working Loads		
size	**minimum breaking load of Wire Rope**	**working load limit (kg/lbs)**
No. 1	80kg/176 lbs	0-10 kg / 0-22 lbs
No. 2	260kg/572 lbs	10-45 kg / 23-100 lbs
No. 3	580kg/1276 lbs	45-90 kg / 101-200 lbs
No. 4	1500kg/3300 lbs	90-225 kg / 210-495 lbs
No. 5	2160kg/4752 lbs	225-325 kg / 496-715 lbs
No. 6	2500kg/5500 lbs	325-500 kg / 715-1100 lbs

The standard range of Hanger Kits should contain galvanized high tensile steel wire rope or stainless steel wire rope as per the application, the minimum specification is as above and should be manufactured to BS 302 (1987), BSEN12385. Comply with manufacturer's load ratings and recommended installation procedures. It should be noted that the testing has been done to the minimum breaking load of the wire giving a minimum safety factor of 5: 1.

Ducting Supports:

a. All ductwork shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with hangers formed of galvanized steel wire ropes and galvanized steel angle/channel or a pair of brackets, connected by galvanized steel wire hangers under ducts, rigid supports may be provided at certain interval if need be**.** The spacing between supports should be not greater than 2 meter. All vertical ductwork shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates or Toggle end wire fixing left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the wire rope hanger shall be welded to the plates. Trapeze hanger formed of galvanized steel wire rope using Gripple shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash/anchor fastener driven into the concrete slab by electrically operated gun. Wire rope supports shall hang through the cleats or wire rope threaded studs can be screwed into the anchor fasteners. In case of non availability of RCC slab Hanger wires shall then hang around the structural support without use of fastners.

b. All horizontal ducts shall be adequately secured and supported. In an approved manner, with trapeze Hangers formed of galvanized steel wire rope in a cradle support method under ducts at no greater than 1800mm centre, for 1801mm-above appropriate size angle along with neoprene pad in between the duct & MS angle should be used with prior approval. All vertical duct work shall be supported by structural members on each floor slab. Duct support shall be through dash / anchor fastener driven into the concrete slab by electrically operated gun. Hanger wires shall then hang around the ducting. Rigid supports shall be used in conjunction with wire rope hangers to assist with alignment of services where recommended for by the manufacturer. Rigid support must also be used in conjunction with wire rope hangers with duct work at each change of direction or connection. Support ducting in accordance with Schedule I at the end of this Section. Any other Gripple solution can be used based on manufacturer’s recommendation on site conditions after prior approval. In cases of Spiral ducting the wire can be wrapped directly around the ducting without the need for a spiral ducting clamp for sizes above 1100 a cradle support should be provided refer to manufacturer’s recommendations.

c. Ducting over furred ceiling shall be supported from the slab above or from beams after obtaining approval of Construction manager/consultant. 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 Contractor’s work in the building. All supports of pipe shall be taken from structural slab/wall by means of fastener.

Catenary Supports: Refer to manufacturer's recommendations on Catenary supports with C clip, special care should be taken with tensioning of the wire and angles at which the installation of services are made.

Stainless Steel Supports should be used for food, chemical and High Corroding environments like areas near coastlines.

Installation should comply with manufacturer's load ratings and recommended installation procedures.

Schedule I: Duct Hanger Schedule

For ducts with external SP upto 250 Pa

Maximum Duct Size (mm)	Gauge	Gripple Hanger No.
1 – 750	26	2
751-1000	26	2
1001-1200	24	3
1201 – 1500	24	3
1501 – 1800	22	4
1801-2100	20	4
2101-2700	18	4

For ducts with external SP upto 500 Pa

Maximum Duct Size (mm)	Gauge	Gripple Hanger No.
1–600 mm	26	2
601-750 mm	26	2
751-1000 mm	24	3
1001-1200 mm	22	4
1201-1300 mm	20	4
1301-1500 mm	18	4
1501-1800 mm	18	4
1801-2100 mm	18	4
2101-2250 mm	18	4
2251-2400 mm	18	4
2401-2700 mm	18	4

Note: All supports are considered at not more 2000 mm interval.

4. Flat Oval Ductwork

4.1 Flat oval duct shall be provided where shown and as shown on the tender drawings.

4.2 Minimum duct wall thickness shall be as indicated in below :

Flat oval duct gauge positive pressure to 10 in.wg.

Major Dimension Duct Width (inch)	Longitudinal Seam	SpiralSeam	Fitting Gauge
TO 24	20	24	20
30	20	22	20
36	20	22	20
42	18	22	18
48	18	22	18
54	18	20	18
60	18	20	18
60	16	20	16
71 and UP	16	18	16

Flat oval duct gauge positive pressure to 2500 Pa.

Major Dimension Duct Width (mm)	Longitudinal Seam (mm)	SpiralSeam (mm)	Fitting Gauge (mm)
TO 600	1.00	0.70	1.00
750	1.00	0.85	1.00
900	1.00	0.85	1.00
1000	1.31	0.85	1.31
1200	1.31	0.85	1.31
1300	1.31	1.00	1.31
1500	1.31	1.00	1.31
1650	1.61	1.00	1.61
1775 and UP	1.61	1.31	1.61

4.3 Reinforcement for flat sides of oval duct shall be of the same size and spacing interval as specified for rectangular duct or shall be provided to limit wall deflection to 3/4 (19mm) and reinforcement deflection to 1/4 (6.4 mm)

4.4 Unless otherwise specified, joints and seams shall be similar to those indicated for round duct.

4.5 Fittings shall conform to the thickness schedules in Table 3-15, shall conform to the seam, joint, and connection arrangements permitted for round duct, and shall be reinforced to conform to 2.4.3.

4.6 The duct construction shall be capable of withstanding a pressure 50 percent greater than that of the assigned pressure class without structural failure or permanent deformation.

4.7 Duct wall deflection at atmospheric pressure, with reinforcements and connections in place, shall not exceed 1/4 in. (6.4 mm) on widths of 36 in. (914 mm) or less or 1/2 in (13 mm) on greater widths. Refer Criteria in Chapter 11 of SMACNA Standards 2005 Third Edition.

4.8 Supports shall conform to those permitted for rectangular duct, with the overall dimensions taken as references.

4.9 <u>Documentation & Measurement of ducting</u>

All ducts fabricated and installed should be accompanied and supported by following documentation :

a. For each drawing, all supply of ductwork must be accompanied by computer generated detailed bill of materials indicating all relevant duct sizes, dimensions and quantities. ln addition, summary sheets are also to be provided showing duct area by gauge and duct size range as applicable.

b. Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

c. All duct pieces to have a part number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement, verification and approvals.

4.10 Testing

After duct installation, total duct work carried out under this scope of works should be tested for leakage. The procedure for leak testing should be followed as per SMACNA -" HVAC Air Duct Leakage test manual" (First Edition-1985)

4. **Air Terminals**

4.1 Dampers

4.1.1 Opposed blade type louver dampers with quadrant and thumb screw lock shall be used at supply air collars for balancing of air distribution system and box type volume control dampers having lever operation shall be used at the outlet of air conditioning equipment or as shown on the approved shop drawings.

4.1.2. All dampers shall be multi blade type of robust construction of galvanized steel unless and until specified otherwise in the Bill of Quantities and tightly fitted. The design, method of handling, and control shall be suitable for the location and service required.

4.1.3 Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation ; control or setting devices shall be made robust, easily operable and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

4.1.4 Dampers shall be placed in ducts and at each supply air collar, whether or not indicated on the drawings, for the proper volume control and balancing of the system.

4.1.5 Automatic and manual volume control opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed out of 1.6mm

steel sheets and blades shall not be over 225mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8mm thickness with fine mesh.

4.1.6 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.

4.1.7 After completion of the duct work, dampers are to be adjusted and set to deliver air flow as specified on the drawings.

4.2 Double Louvered Grilles

4.2.1 The supply air grilles shall be fabricated from extruded aluminium sections. The supply air grilles shall have double adjustable louvers i.e. front horizontal and rear vertical louvers, both adjustable. The louvers shall be suitable to hold deflection settings under all conditions of velocity and pressure. The grilles shall be provided with outer frame. The louvers shall be pivoted in Nylon bushes for smooth operation for return air grilles similar to supply air as described above will be provided but with out volume control damper. The grilles shall be painted as per approved powder coated shade.

4.2.2 Volume control dampers in extruded aluminium construction shall be factory fitted for supply air grilles.

4.2.3 Longer grilles having size more than 45cm shall have intermediate supports for the horizontal louvers. The sample of grille shall have to be got approved by the consultants before delivery.

4.3 Linear Grilles

4.3.1 The linear supply cum return air grilles shall be fabricated from extruded aluminium sections. Flanges shall be of minimum 1.3 mm thick extruded aluminium suitable to hold the louvers tightly in fixed position.

4.3.2 Louvers shall be minimum 3mm thick throughout of extruded aluminium construction with 15 degree deflection unless and until specified otherwise. Grilles shall be provided with removable/fixed internal core as mentioned in the BOQ. The sample of grille shall have to be got approved by the consultants before delivery.

4.3.3 All sections of grills shall be powder coated for color and shade as approved by the Architects to match interior finishes.

4.3.4 Linear grilles at each supply air outlet shall be provided with volume control dampers as mentioned above and accounted for in BOQ separately. The linear grilles shall be fixed in to a plenum chamber having GI spacers with concealed screws. End pieces or corner pieces shall be provided as required.

4.4 Diffusers

4.4.1 Square ceiling diffuser shall be anti-smudge ring type fabricated out of extruded aluminium sections. The four directional air flow diffuser shall consist of outer ring fixed to duct collar with concealed screws. Foam gasket shall be provided between outer ring and suspended ceiling. The central core shall be clip fixed to the outer ring.

4.4.2 Opposed blade volume control damper in extruded aluminium construction shall be fixed to the neck of diffuser. The damper shall be adjusted after removing the central core.

4.4.3 All sections of diffusers shall be powder coated for color and shade as approved by the Architects to match interior finishes. The sample of diffuser shall have to be got approved by the consultants before delivery.

4.5 Multislot Linear Diffuser

Linear ceiling diffuser shall be multislot type. The diffuser shall be fabricated out of extruded aluminium sections. Each slot shall be 19mm wide. Each slot shall be equipped with air flow direction control louver mechanically fixed. Integral sliding type hit & miss type volume control damper in extruded aluminium construction shall be provided for each slot for fine control of air flow in supply air portion only. The damper shall be fabricated out of anodized extruded aluminium sections.

Other sections of ceiling diffuser shall be powder coated in colour & shade approved by the Consultants/Architects.

The linear diffuser shall be fixed in to a plenum chamber with concealed screws. Side end pieces or corner pieces shall be provided if required.

4.6 Air Transfer Grille

4.6.1 Air transfer grilles shall be in extruded aluminium construction. The grilles shall be complete with single /double frame suitable to be fixed on the door panel from both sides. The central core shall be no-see-thru type.

4.6.2 The grilles shall be anodized or powder coated in colour and shade as approved by the Architects. The grilles shall be provided with insect screen.

4.6.3 The ATGs shall be provided at the door of pantry and toilets as shown in the approved drawings. The sample of grille shall have to be got approved by the consultants before delivery.

5. Painting

5.1 All grilles and diffusers shall be powder coated at factory prior to delivery at site of approved color and shade.

5.2 All ducts immediately behind the grilles/diffusers etc. to be applied with two coats of black paint in matt finish.

6. Fire cum Smoke Dampers

Bare Dampers

a. All supply and return air ducts/ return air spaces at AHU room crossings and at all floor crossings shall be provided with approved make motorized fire and smoke dampers of at least 90 minutes fire rating as certified by CBRI Roorkee, India as per clause 10 of UL:555-1995. These dampers shall be multi-leaf type –Ruskin.

b. Fire damper blades and outer frame shall be formed out of 1.6mm (16G) galvanized steel sheet of length as mentioned in the approved for construction shops drawings tilted as AHU Room Blow Up. The damper blade shall be pivoted on both ends using chrome-plated spindles in self-lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16 gauge galvanized sheet steal. For preventing smoke leakage, metallic compression side seals shall be provided. Dual side leakage shall be provided for better structural stability. The construction of the fire damper shall allow maximum free area to reduce pressure drop and noise in the air passage, in normal position damper blade shall be held in open position with the help of a 220 V operated electric actuators thereby providing maximum air pressure without creating any noise or chatter.

c. For wall mounted fire dampers retaining MS angles duly painted with black enamel paint shall be supplied and installed by HVAC Contactor as per established installation procedure. Whereas the fire damper is also used for Smoke management (Smoke and fire damper) the same shall be as per UL-555 S-Class-II.

d. Every motorized fire damper/ Smoke and fire damper shall be tested in the factory and will be certified by the manufacturer in form of the test certificate.

e. Fire dampers shall also be supplied with spring locked fusible link rated for 72^0C (UL stamped) to close fire damper in event of rise in duct temperature.

f. For fire dampers/ smoke fire dampers of size higher than one approved by certifying agency the damper shall be supplied in multiple units of size not exceeding the tested damper by CBRI. All the multiple units shall be housed in a common factory fitted sleeve.

g. The fire dampers shall be mounted in fire rated wall with a duct sleeve 400mm/ 500mm long depending upon the wall thickness. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of galvanized sheet shall be 18 gauge.

h. The damper shall be installed in accordance with the installation method recommended by the manufacturer.

Actuators

The actuator shall be maintenance free coupled spring return type suitable to work on 24V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/ close the damper. The selection of actuator size shall be the responsibility of the manufacturer of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature. Other features of the damper actuator shall be as under:

a. Actuator shall have tamper proof housing with IP-54 protection rating.

b. Actuator shall have mechanical integrity of at least one hour at 900^{o}C.

c. Actuator shall have minimum 600000 safe position at rated torque. It shall be capable to withstand temperature of 75^{o}C for 24 Hrs.

d. Actuator shall have electronic over load or digital sensing circuit to prevent damage to actuator.

e. Should be capable of changing direction of rotation by changing mounting orientation .

f. Actuator shall have manual over ride facility.

Damper actuator shall be such that it should close the damper in the event of power failure automatically and open in the same manner in case of power being restored.

Control Panels

The control panel shall be supplied by damper manufacturer fitted on damper compatible with damper actuators. The control panel shall have at least following features:

a. Power on lamps with 230 V/ 24 V Transformer.
b. Damper close and open indication.
c. Reset push button.
d. Push button for manual running of actuator for periodic inspection.
e. Auxiliary contacts 24V/ 230V.
f. Contact points to receive signal from smoke detector/ fire alarm panel.
g. Additional terminal shall be provided to have signal (audio or visual) in central control room.

In addition the Control panel shall have following features as well :

- Potential free contacts for AHU fan/Pkg Unit ON/ Off and remote alarm indication.
- Accept signal from external smoke / fire detection system for tripping the electrical actuator.
- Test and reset facility.
- Indicating lights / contacts to indicate the following status:
- Power Supply On
- Alarm

.

The control panel shall receive 230V A/C supply and interconnecting wiring between control panel and actuator shall be carried out using fire proof cables.

The Contactor shall ensure that all electrical connections are suitably terminated. The HVAC Contractor shall also check continuity of electrical circuit as recommended by the manufacture. Fire damper inspection door will be provided in AC duct to facilitate access to the system.

7. Flexible Ducts

The scope of this section comprise supply, installation testing and commissioning of flexible ducting conforming to these specifications and in accordance with requirements of drawings and schedule of quantities.

Wherever specified, uninsulated flexible duct shall be made of double lamination of metalized aluminium film permanently bonded to a coated spring steel wire helix. Duct shall be in tear and puncture resistant construction.

Wherever insulated flexible ducts are specified, inner & outer core for the same should be made of aluminium permanently bonded to a coated spring steel wire helix. Fiberglass insulation of minimum 24Kg/m^3 density, 25mm thickness shall be sand witched in between inner & outer core.

Care must be taken to install all the flexible duct in fully extended position and bends made with adequate radius as per manufacturer recommended practices.

8. **Testing and Balancing**

8.1 After completion of the installation of the complete air distribution system, all ducts shall be tested for air leaks.

8.2 Before painting the interiors, air distribution system shall be allowed to run continuously for 48 hours for driving away any dust or foreign material lodged within ducts during installation.

8.3 The entire air distribution system shall be balanced using approved anemometer. Air quantities at the fan discharge and at various outlets shall be identical to, or less than 5 percent in excess of, those specified and quoted. Leakage in each air distribution system shall be within 3 percent so that supply air volume at each fan shall be identical to , or no greater than 3 percent in excess of, the total air quantity measured at all supply outlets served by the fan. Branch duct adjustments shall be made by volume or splitter dampers. Dampers shall be permanently marked after air balance is complete so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted to the Consulting Engineer for scrutiny and approval, and six copies of the approved report shall be provided with completion documents.

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E. "SPECIFICATIONS - INSULATION"

1. Scope

The scope of this section comprises of supply and application of insulation conforming to these Specifications and as shown on the drawings & BOQ.

2. Duct Insulation (External)

Material

Insulation material shall be closed cell elastomeric material (nitrile rubber) having fire retardant Class "O" properties. Density of insulation material shall range between 0.04-0.07 gm/Cucm. Thermal conductivity (K value) at 40 C mean temperature and Service temperature limit shall be 0.039 W/M.K and –40C to 105C respectively. Water vapour permeability shall not be less than 7000 Kg/Pa/s.m. Water absorption shall not be more than 1.5% by weight. Insulation material shall have excellent ozone resistance properties. Excellent Thermal Stability. Insulation material shall be tested for the said properties in accordance with the relevant international codes including BS 874 Part 2 1986, DIN 52612(K Value), DIN 52615 (Water vapour permeability), BS 476 Part6 & Part7 (Flammability).

Application

Duct insulation shall be applied as follows :

a. External surface of the ducts to be cleaned vigorously to remove dirt and any other foreign material from the surface of the ducts.

b. Apply Low VOC adhesive Fevicol AC duct King Eco Fresh/equivalent on the surface of ducts.

c. Wait for around half an hour to develop Tack until the adhesive layer got colorless.

d. Wrap factory aluminum foil laminated/IC cladding finish closed cell insulation material having thickness as mentioned in BOQ butting all joints. All joints to be sealed with adhesive.

3. Accoustic Lining

3.1 Material

Insulation material shall be resin bonded fibre glass. The Thermal conductivity of the insulation material shall not exceed 0.034 K cal./ hr-SqM C/M or 0.27 Btu/hr sft- F/inch at 32 C (90 F) mean temperature, and density shall not be less than 32 Kg/ CuM (2.0 lb/c.ft). Thickness of the insulation shall be as specified for the individual application. Samples of insulation material shall be submitted for approval.

3.2 **Application**

3.2.1 **Duct Lining (Internal)**

Acoustical lining of duct wherever specified shall be applied as under :

a. Internal surface of the ducts to be cleaned vigorously to remove dirt and any other foreign material from the surface of the ducts

b. 22 gauge G.S. Sheet channel frames having size 25mm wide & depth equal to thickness of insulation to be fixed at maximum 600mm centre, screwed to the sheet metal using brass metal screws.

c. Fibre Glass blankets of 32 Kg/CuM density and thickness as mentioned in the BOQ to be fixed in the G.S. sheet channel frame work with joints well butted together. Thereafter, insulation shall be covered with R.P tissue.

d. Finally cover the insulation with 26 SWG perforated aluminium sheet having at least 20% perforation with joints overlapped and screwed to the G.S. Sheet channel frame using brass metal screws, to produce an even surface.

OR

3. **Acoustic Lining of Ducts**

3.1 **Material**

Acoustic insulation material shall generally possess the properties mentioned above, however, insulation material shall be processed Nitrile Rubber Foam having fire retardant Class "O" properties. Density of insulation material shall range between 140-180 Kg/CuM. The insulation material shall conform to the international codes including BS 476 Part6 & Part7 (Flammability).

3.2 **Application**

Acoustical lining of duct wherever specified shall be applied as under:

a. Internal surface of the ducts to be cleaned vigorously to remove dirt and any other foreign material from the surface of the ducts

b. Apply Low VOC adhesive Fevicol AC duct King Eco Fresh/equivalent on the surface of ducts.

c. Wait for around half an hour to develop Tack until the adhesive layer got colorless.

d. Cut foamed sheets into required sizes using sharp knives. Apply adhesive on the foam and stick it to the duct surface.

Note: Specifications shall be applicable as specified in the BOQ.

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F. "SPECIFICATIONS - ELECTRICAL WORK"

1. Scope

In general, the contractor shall supply, store, erect, test and commission all the equipment required for Electrical Installation. The contractor shall furnish all the materials, labour, tools and equipments for the electrical work, as shown in the accompanying drawings and in the bill of quantities and specifications hereinafter described.

2. Definitions

The following abbreviations used in the bill of quantities specifications and drawings represents:

ISS	-	Indian Standard specification.
IER	-	Indian Electricity Rules, 1956.
BS	-	British Standard (where specifically called for)
BSCP	-	British Standard Code of Practice (if called for).
HRC	-	High Rupturing Capacity
GI	-	Galvanised Iron
MS	-	Mild Steel
CI	-	Cast Iron
APLSTS	-	Aluminium conductor, paper insulated lead sheathed, Double steel tape armoured and serving.
PVC	-	Polyvinyl Chloride.
XLPE	-	Cross Linked Polyethylene.
HT	-	High Tension.
LT	-	Low Tension.
A-Amp	-	Ampere.
KV	-	Kilo Volts.
PT	-	Potential Transformers.
CT	-	Current Transformers.
OCB	-	Oil circuit Breakers
VCB	-	Vacuum Circuit Breaker
ACB	-	Air Circuit Breakers
SFU	-	Switch fuse Unit
COS	-	Change Over Switch
CFS	-	Combination Fuse Switch
MCCB	-	Moulded Case Circuit Breaker.
MCB	-	Miniature Circuit Breaker

IC	-	Iron Clad
ICTPN	-	Iron Clad Triple Pole and Neutral
ICDP	-	Iron Clad Double Pole
DB	-	Distribution Board
KVA	-	Kilo Volts Ampere.
KVAR	-	Kilo Volts Ampere - Reactive.
NC	-	Normally Close
NO	-	Normally open
SWG	-	Standard Wire Gauge.

3. REGULATION & STANDARDS

The installation shall conform in all respects to Indian standard Code of Practice for Electrical Wiring Installation I.S. - 732 and 'National Electrical Code'. It shall be in conformity with the current I.E Rules and Regulations and requirements of the local Electric Supply Authority in-so- far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship then those required by any of the above regulations, this specifications shall take precedence over the said regulations and standards.

In general, the materials, equipments and workmanship not covered by the above, shall conform to the following Indian Standards (Latest Edition) unless otherwise called for:

a. **SWITCHGEAR**

- Requirements of A.C. Circuit Breakers. : IS 2516 (Part I) Sec.1,2 & 3 (Part-II)

- Switches and Switch Isolators above 1000V
- But Not Exceeding 1.1 KV : IS 4710

- Markings & arrangements for switchgear
- bus-bars, main connection & auxiliary wiring : IS 375

- Specification for normal duty air break switches & composites unit for air break switches and fuses for voltage not exceeding 1000 Volts. : IS 4064

- Heavy duty air-break switches and composite units of air-break switches and fuses for voltages not exceeding 1000 Volts. : IS 4047

- Specification for miniature circuit breakers. : IS 8828

- Specification for enclosed distribution, fuse boards and cut-outs for voltage not exceeding 1000 Volts : IS 2675

- Installation and maintenance of switchgear. : IS 3072 (Part I)
- HRC cartridge fuse links 650 Volts. : IS 2208

b. **CABLE & MISCELLANEOUS ITEMS**

- Specification for paper insulated and lead sheathed cables : IS 692
- Code of Practice for installation and maintenance of paper insulated power cables (upto and including 33 KV) : IS 1255
- Specification for PVC insulated (Heavy Duty) electric cables Part-I for Voltage upto 1100 Volts. : IS 1554
- Specification for PVC insulated cables (for voltage upto 1100 V) (Part-II) with Aluminium conductors. : IS 694 (Part-II)
- Specification for rigid steel conduit for electrical wiring. : IS 9537
- Specifications for rigid non metallic conduits for electrical installations. : IS 9537
- Specifications for accessories for rigid steel conduits for Electrical wiring. : IS 3837
- Box for the enclosure of electrical accessories steel and C.I. Boxes. : IS 5133 (Part I)
- 3Pin plugs and sockets outlets : IS 1293
- Adhesive insulating tapes for Electrical purposes (Part- I & II) : IS 2448
- Propeller type AG Ventilating fans : IS 2312
- Code of Practices for earthing. : IS 3043
- Glossary of terms for electrical cable and conductors. : IS 1885
- Code of Practice for buildings (General) Electrical installation : IS 1646

- Current Transformers : IS 2705 (Part-I to III)
- Voltage Transformer : IS 3156 (Part-I to III)
- Shunt capacitors for Power system : IS 2834
- Direct acting electrical indicating instruments : IS 1246
- Factory assembled switchgear : IS 8623
- Rating for Cable : IS 3961 (Part -II)
- Earthing : IS 3843

3. **INSPECTION & APPROVAL OF THE WORK BY LOCAL AUTHORITY**

On completion of this work, the contractor shall obtain and deliver to the owners the certificates of inspection and approval by electrical inspectorate of Local Administration. The fees paid for inspection will be reimbursed on production of challan/receipt. The contractor shall include in his rates all charges necessary for getting electrical installation approved which includes Sub-station, LT distribution, etc. by the Chief Electrical Inspector to the state government or/ and from any other authority required for this job.

5. INSPECTION OF MATERIALS

The Architect/ owners shall have access to the manufacturer's premises for inspection of any items of the tender for which contractor has made arrangement with manufacturer/ suppliers. All such inspection shall not need any prior intimation by the owners or architects.

6. WORKING DRAWINGS & SHOP DRAWINGS

The contractor shall prepare and submit to the Architects/ owners for approval detailed working drawings & shop drawings of all MCC/panels ,cable layout, earthing etc.

7. AS BUILT DRAWINGS

At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit to the Architect/ employers layout drawings drawn on tracing film and approved scale indicating the complete wiring as installed.

8. ENGINEER/ SUPERVISOR

The contractor shall employ a competent, licence, qualified full time electrical engineer / supervisor to direct the work of electrical installations in accordance with the drawings and specifications. The engineer / supervisor shall be available at all times at the site to receive instructions from the Architect/employers in any day to day activities throughout the duration of the contract. The engineer & supervisor shall correlate the progress of the work in

conjunction with all the relevant requirements of the supply authority. The skilled workers employed for the work should have requisite qualifications and should possess competency certificate from the Electrical Inspectorate of Local Administration.

9. APPLICATION FOR ELECTRIC SUPPLY/ LIASON

The Contractor shall be responsible for filing and follow up application for electric supply to the project. The contractor shall carry out all the liason work required for obtaining electric supply at site commencing from filing of application. This liason shall be deemed to be a part of the contract.

GENERAL SPECIFICATION FOR: MEDIUM VOLTAGE POWER CONTROL CENTRE AND SWITCH BOARD PANELS:

1.1 GENERAL:

Medium voltage power control centres (generally termed as switch board panels) shall be in sheet steel clad cubicle pattern, free floor standing type, totally enclosed, compartmentalized design. This specification shall cover the following types of panels :

a) Air circuit breaker panels - Drawout type with single or double tier arrangement as per design shown on the drawings.

b) Panels with one or more Air circuit breakers with Draw-out arrangement and switch-fuse units/moulded case circuit breaker of non-drawout design.

c) Panels with switch- fuse unit/moulded case circuit breaker of non- drawout type. However, the switch-fuse units can have drawout fuse-carriage if a particular make of switch-fuse is used.

The panels shall generally be of extensible type with provision for bus extension on or both sides as desired at the time of approved of shop drawings.

1.2 CODE/STANDARDS :

The panels shall generally conform to the requirements of following codes/ specifications:

a)	IS-8623	h)	IS-2705
b)	IS-4237	i)	IS-722
c)	IS-2147	j)	IS-4064
d)	IS-3072	k)	IS-2208
e)	IS-375	l)	IS-6875
f)	IS-1248 & 2419	m)	IS-6005
g)	IS-5082		

The equipment shall conform to Indian Electricity Rules as amended upto-date.

The supplier shall examine the provision of these codes and confirm or indicate his comments.

1.3 CONSTRUCTION :

Power control centres/ switch board panels shall of free standing type, with sheet steel enclosure having following features :

a) The panel shall be constructed of sheet steel of minimum 1.6mm thickness. The internal frames shall be made of structural steel angles or made up sections (as per standard design of the manufacturer) specifications of which, shall be submitted along with offers.

b) The panel shall be compartmentalised to accommodate one feeder n each compartment. The main bus bar chamber shall be provided at the top of panel or bottom of the panel as required. The compartments shall be arranged in section with metallic/ phenolic barrier in between.

A vertical cable alley of at least 200mm width shall be provided to serve one/ two vertical section of feeders. Cable alley shall have hinged door/ doors with rubber gaskets. Suitable

cable clamping arrangement with slotted steel members shall be provided in the cable alley. Similarly, vertical bus bar shall be housed in-between two feeder compartments in a separate bus chambers. The opening between bus chamber and feeder compartments shall be properly covered with Bakelite/ Hylam sheets of 3mm minimum thickness. The vertical bus chamber shall be provided with removable bolted covers on the front and back side. All the interconnecting links to the feeders shall be shrouded so as to avoid accidental contact, by means of phenolic barriers.

c) Each compartment shall have its own hinged door with concealed hinges. The doors shall have heavy duty rubber gasket fixed on the inner side of the door. The door shall have interlocking facility with the feeder unit.

d) The Panel shall have punched openings for mounting meters, lamps, push buttons, relays, etc.

e) The dimensions of feeder compartments, bus chambers and cable alleys shall be as shown on the relevant drawings. However, the following minimum dimensions shall be strictly adhered to :

i. ACB compartment : Drawout -600mm wide x 1000mm deep x 900mm high.

ii. SWITCH FUSE UNITS/MOULDED CASE CIRCUIT BRACKER (NON-DRAWOUT TYPE) :

Up to 63A/ 100A : 300mm wide x 225mm high x 400mm deep

250A : 400mm wide x 400mm high x 400mm deep
400A to 630A : 400mm wide x 500mm high x 400mm wide.
(or vice- versa).

iii. BUS CHAMBER :

Main bus (Horizontal) : 400mm high x 300mm deep

Vertical bus (Feeder bus) : 300mm wide x 400mm deep

iv. Cable alley : Min. 200mm wide.

These dimensions are furnished as a guide and the clearances required in between each live bus/ link and between bus/ links to the earth (panel wall/ sheet) shall be as per relevant Indian Standard Code of practice. However, minimum clearance between neutral bus and earth shall not be less than 25mm. The panel supplier shall furnish detailed sectional drawings and also arrange to get the panel inspection done at intermediate stages of fabrication to avoid fault defective febrication of the panels (however, the compliance of these specifications shall entirely be the suppliers' responsibility).

1.4 BUS BARS :

a) The bus bars shall be suitable for 3 phase, 4 wire, 415 volts 50 Hz AC supply. The bus bars shall be made of high conductivity aluminium. The bus bars shall have uniform cross-section throughout the length. The bus bars shall be designed for carrying rated-current continuosly. The bus bars and links shall be designed for a maximum temperature of $75^{O}C$. The max. current density of bus bars shall be as follows:

i. Copper : 1.86 Ampere/ Sq.mm. of cross section area.
ii. Aluminium : 1.28 Ampere/ Sq.mm. of cross section area.

It may be noted that these ratings are the upper limit to which the bus could be stressed. Suitable derating factors shall be applied to arrive at the correct cross section of bus bars.

b. Bus bars shall be supported on suitable non hygroscopic, non combustible, material such as DMC/ SMC at sufficiently close intervals to prevent bus bar sag. All bus bar joints shall be provided with high tensile steel bolts (electro plated with suitable metal such as Nickel/ Cadmium), spring washer and nuts so as to ensure good contact. Alternatively, electroplated/ tinned brass bolts shall be used. The joints shall be formed with fish-plates on either side of bus bar to provide adequate contact area. Bus supports shall be provided on either side of joints (max. unsupported distance from the joint 400mm)

c. Power shall be distributed to feeders in dual section by a set of vertical bus bars (Phases+neutral). Individual module shall be connected to the vertical bus bars through sleeved connections.

d. Bus bars shall be insulated with PVC sleeves (heat shrink type) with colour coding (Red/ Blue/ Yellow/ Black).

e. The bus bars and their supports shall be able to withstand thermal and dynamic stresses due to the system short-circuits. The supplier shall furnish calculations alongwith his drawing establishing the adequacy of bus bars both for continuous duty and short -circuit rating. Short circuit withstand capacity shall be for one second. Calculations for spacing of supporting of supports shall also be furnished.

1.5 EARTHING :

The panels shall be provided with a copper earth bus running throughout the width of the switchboard. Suitable earthing eyes/bolts shall be provided on the main earthing bus to connect the same to the earth grid at the site. Sufficient number of star washers shall be provided at the joints to achieve earth continuity between the panels and the sheet metal parts.

1.6 MOUNTINGS :

Panels incorporating switchfuse units shall have suitable compartments of standard width. Each compartment shall incorporate a heavy duty load break switch fuse and HRC fuses. Suitable cable termination arrangement shall be provided for switch fuse/ fuse-switch unit feeders. Equipment shall be provided with proper fastening arrangements to ensure vibration free operation. Proper designation as given on the respective drawings, shall be provided for every equipment.

Circuit breakers shall be mounted such that they are accessible from the front of the panel. More than two circuit breakers shall not be incorporated in a vertical section. The breakers compartment shall be divided into two parts, one for the breaker and the other for incorporating associated control gear. The necessary instrumentation shall be provided on the door of the compartment.

1.7 INTERLOCKING

The panels shall be provided with the following interlocking arrangements :

a. The door of the feeder compartments is so interlocked with the switch drive or handle that the door can be opened only if the switch is in “OFF” position. De-interlocking arrangement shall also be provided for inspection.

b. It shall not be possible for the breakers to be withdrawn when in “ON” position.

c. It shall not be possible for the breakers to be switched “ON” unless it is either in fully inserted position or for testing purposes it in fully isolated position.

d. The breaker shall be capable of being racked into “testing”, “isolated” and maintenance position and kept in any of these positions.

e. A safety catch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle shall be provided.

1.8 PROTECTION AND INSTRUMENTATION :

Protection and instrumentation shall be as per standard specification.

1.9 WIRING

All the interconnections between the incoming, bus and the outgoings of 100A and above rating shall be done by insulated links/ strips of suitable sizes. Switch fuses and equipments below 100A rating shall be wired with PVC insulated copper conductors. The wiring for instrumentation protection and control equipment shall be carried out with PVC insulated flexible copper conductors.

The Power interconnections shall be carried out by means of bolted connections with washers. The wiring shall be terminated by using crimping sockets. Wring shall be laid out neatly in bunches which are fastened to the steel members of the panel. All the potential circuits shall be protected by fuses mounted near the tap-off point from the main connections.

1.10 TERMINALS:

All the control, instrumentation and protection wiring shall be provided with printed PVC ferrules at both ends. For terminating control cables on to the equipment in the panels, suitable terminals blocks shall be provided. The terminal shall also be numbered for easy identification and maintenance.

1.11 SURFACE TREATMENT

All sheet metal accessories and components of power, control centres and switchboard panels shall be thoroughly cleaned, degreased, derusted and phosphatised before redoxide primer is applied. The panel shall be stove enameled to the required final finish. The interior surfaces of the panel shall also be painted to required shade. The supplier shall indicate in his offer, if there is any deviation from the treatment specified above.

1.12 ENCLOSURES

The panel enclosure shall be dust and vermin proof and shall be suitable for indoor installation. Enclosure design shall be in accordance with the requirements of IP 54 as per IS- 2147-1962. The supplier shall confirm whether this requirement is met and a type test certificate furnished. If type test certificate for IP-54 is not available, the same shall be brought out clearly in his offer.

1.13 NAME PLATE

The panel as well as the feeders compartment doors shall be provided with name plates giving the switchboard/ feeder descriptions as indicated on the drawings.

1.14 TESTING

The power control centres shall be tested at factory after assembling of all components and completion of all interconnections and wiring. Tests shall be coducted in accordance with the requirements relevant IS Codes/ specifications.

a. INSULATION TEST

i. Insulation of the main circuit, that is, the insulation resistance of each pole to the earth and that between the poles shall be measured.

ii. Insulation resistance to earth of all secondary wiring should be tested with 1000V megger.

Insulation test shall be carried out both before and after high voltage test.

b. HIGH VOLTAGE TEST :

A high voltage test with 2.5KV one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed. All units racked in position and the breakers closed. Original test certificate shall be submitted along with panel.

1.15 STORING, ERECTION AND COMMISSIONING

a. STORING

The panels shall be stored in a well ventilated, dry places. Suitable polythene covers shall be provided for necessary protection against moisture.

b. ERECTION

Switchboards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. The switch boards shall be properly aligned and bolt000ed to the foundation by atleast four bolts. Cable shall terminated on the bottom plate or top plate as the case may be, by using brass compression glands. The individual cables shall then be lead through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switch board earth bus shall be connected to the local earth grid.

c. PRECOMMISSIONING TESTS :

Panels shall be commissioned only after the successful completion of the following tests. The tests shall be carried in the presence of engineer-in-charge.

i. All main and auxiliary bus bar connections shall be checked and tightened

ii. All wiring terminations and bus bar joints shall be checked and tightened.

iii. Wiring shall be checked to ensure that it is according to the drawing.

iv. All wiring shall be tested for insulation resistance by a 1000V megger.

v. Phase sequence/ rotation shall be estimated.

vi. Suitable injection tests shall be applied to all the measuring insuring instruments to establish the correctness and accuracy of calibration and working order.

iii. All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit.

GENERAL SPCIFICATION FOR : MOULDED CASE CIRCUIT BREAKERS

1.1 GENERAL :

Moulded case circuit breakers or fuse free breaker shall be incorporated in the switch board wherever specified. MCCBS shall conform to BS : 3871 Part II or JIS-C-8370 in all respects. MCCBS shall be suitable either for single phase 230V or three phase 415volts.

1.2 CONSTRUCTION :

The MCCB and case shall be made of high strength heat resistant and flame retardant thermo- setting insulating material. Operating handle shall be quick make/quick break, trip-free type. The operating handle shall have suitable “ON”, “OFF” and “TRIPPED” indicators. Three phase MCCBS shall have a common operating handle for simultaneous operation and tripping of all the three phase. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal-magnetic type provided on each pole and connected by a common trip bar such that tripping of any one pole actuates three poles to open simultaneously. Thermal magnetic/tripping device shall have IDMT characteristics for sustained over loads and short circuits. Contact tips shall be made of suitable are resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearances.

1.3 ACCESSORIES :

MCCBS shall be provided with the following accessories, if specified in schedule of quantities:

i. Under voltage release
ii. Shunt release

iii. Alarm Trip alarm
iv. Auxiliary contacts.

1.4 INTERLOCKING :

Moulded case circuit breakers shall be provided with the following interlocking devices for interlocking the door of switch board:

a. Handle interlock to prevent unnecessary manipulation of the breaker.
b. Door interlock to prevent the door being opened when the breaker is in “ON” position.
c. De-interlocking device to open the door even, if the breaker is in “ON” position.

1.5 RUPTURING CAPACITY:

The moulded case circuit breaker shall have a returning capacity of not less that 10KA Rms at 415 volts. Wherever required, higher rupturing capacity breakers to meet the system short circuit fault shall be used. All such ratings shall be as per equipment schedule/B.O.Q.

1.6 TESTING:

a. Original certificate of the MCCBS as per BS:3871 or JS-C-8370 shall be furnished.
b. Pre-commissioning tests on the switch boards panel incorporating the MCCB shall be done as per specifications.

GENERAL SPCIFICATION FOR: MEDIUM VOLTAGE CABLES

1.1 TYPE :

Medium voltage cables shall be aluminium conductor, PVC insulated, PVC sheathed and steel wire armoured or steel tape armoured construction. Aluminium conductors up to 10sq.mm. may be solid, circular in cross section, and sizes above 10sq.mm. shall be stranded. Sector shaped stranded conductors shall be used for sizes above 25sq.mm. The cable shall conform to IS 1554 (Part I).

1.2 RATING

The cable shall be rated for a voltage of 650/1100 Volts.

1.3 CONSTRUCTION

The conductors for power cables shall be made of electrical purity aluminium & that for control cable from annealed high conductivity copper. The conductors shall be insulated with high quality PVC base compound. A command covering (bedding) shall be applied over the laid up cores by extrusion or wrapping of a filling material containing unvulcanized rubber or thermoplastic material, armouring shall be applied over the inner shath of bedding, over the armouring a tough outer sheath of PVC sheathing shall be extruded. The outer sheath shall bear the manufacturers name and trade mark at every 30 meter interval.

1.4 CORE IDENTIFICATION :

Core shall be provided with the following colour scheme of PVC insulation.

i.	Core	:	Red/Black/Yellow/Blue
ii.	Core	:	Red and Black
iii.	Core	:	Red, Yellow, and Blue
iv.	3.5/4 core	:	Red, Yellow, Blue and black.

1.5 CURRENT RATINGS :

The current rating shall be based on the following conditions.

i.	Maximum conductor temperature	:	$70^{O}C$
ii.	Ambient air temperature	:	$40^{O}C/50^{O}C$
iii.	Ground temperature	:	$70^{O}C$
iv.	Depth of laying	:	75cm

1.6 SHORT CIRCUIT RATING:

Short circuit ratings for the cables shall be as specified in IS : 1554 Part -I.

1.7 SELECTION OF CABLES :

Cables have been selected considering the conditions of the maximum connected load, ambient temperature, grouping of cables & the allowable voltage drop. However, the contractor shall recheck the sizes before the cables are fixed and connected to the service.

a. Storing

All the cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drums in vertical position.

b. Laying

Cables shall be laid as per the specifications given below. The system adopted for this job shall be as per BOQ :

i. Cable on Tray/ Racks:

Cables shall be laid on cable trays/ racks wherever specified. Cable racks/trays shall be of ladder, trough or channel design suitable for the purposes. The nominal depth of the trays/ racks shall be 150mm. The width of the trays shall be as per the design shown on drawing. The cable trays shall be made of steel or aluminium. The trays/ racks shall be completed with end plates, tees, elbows, risers, and all necessary hardware. Steel trays/ Rack shall be painted with two coats of enamel paint of approved shade over a coat of red oxide primer. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles made of

aluminium strips with PVC covering shall be used for securing the cables to the cable trays. The cable trays shall comply with following requirements :

1. The trays shall have suitable strength and rigidity to provide adequate supports for all contained cables.

2. It shall not present sharp edged, burrs or projections injurious to the insulation of the wiring/ cables.

3. If made of metal, it shall be adequately protected against corrosion or shall be made of corrosion resistant material.

4. It shall have side rails or equivalent structural members.

5. It shall include fittings or other suitable means for changes in direction and elevation of runs.

1.9 INSTALLATION

1. Cable trays shall be installed as a complete system. Trays shall be supported properly from the building structure. The entire cable tray system shall be rigid.

2. Each run of the cable tray shall be completed before the installation of cables.

3. In portion where additional protection is required, non combustible covers/ enclosures shall be used.

4. Cable tray shall be exposed and accessible.

GENERAL SPECIFICAITON FOR: EARTHING FOR ELECTRICAL WORK

1.1 General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043. All metal conduits, trunkings, cable armour, switchgear, distribution boards, meter, light fixtures, fans and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes. Earthing shall also be in conformity with the provisions of Rules 32, 61, 62, 67 & 68 of IER 1956. These specifications apply to both copper and GI earthing system. The material to be used shall be as per that give in BOQ.

1.2 Earthing Conductors

1.2.1 All earthing conductors shall be of high conductivity copper or GI and shall be protected against mechanical damage and corrosion. The size of earth conductors shall not be less than half that of the largest current carrying conductor. The connection of earth continuity conductors to earth bus and earth electrodes shall be strong and sound and shall be easily

accessible. The earth tapes shall be joined together using double rivets. The earthing conductor shall be laid in cable trenches, cable trays or conduits or on cable by using suitable clamps made of non-ferrous metals compatible with the earthing conductor. The following earthing conductors and required to be used for various sections of the installations.

a. 10SWG bare copper wire or GI wire.

b. All single phase switches and DBs above 30A and upto 63A rating shall be earthed with one run of 8SWG bare copper wire or GI wire.

c. All three phase switches/ DBs upto 30A rating shall be earthed with 2 runs of 10SWG copper wire/ GI wire.

d. All three phase switches/ DBs above 30A and upto 63A shall be earthed with 2 runs of 8 SWG copper wires/ GI wires.

e. All three phase switches/DBs above 63A and upto 100A shall be earthed with 2 runs of 25x3mm Copper Strip/GI Strip.

f. All three phase switches/DBs of 200A rating and above shall be earthed with 2 runs of 25x6mm copper Strip / GI Strip.

g. All motor frames shall be earthed by two earthing conductors of specified cross section.

Earth conductors shall be properly terminated with bolts to the frames of panels/eqpts. And provided with crimped sockets in case of wires.

1.2.2 Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage net-work and soil resistivity.

1.2.3 All the sub mains and sub circuits shall be provided with earth continuity conductors as specified and connected to the main earth bus. Earthing conductors for equipment shall be run from the exposed metal surface of the equipment and connected to a suitable point on the sub main or main earthing bus. All switches shall be connected through double earthing conductor to the earth bus. Earthing conductors shall be terminated at the equipment using suitable lugs, bolts, washers and nuts.

1.2.4 All conduits, cable armouring, raceway, rising mains, etc. shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area, sprinkler, pipes, LPG pipes, water pipes, steel structural elements, cable trays/ racks lighting conductors shall not used as a means of earthing an installation. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/ protective device a circuit breaker and shall not exceed 2 ohms. As rough guide the following sizes of earth continuity conductors shall be used for circuit wiring.

Size of circuit wires/ cables	Size of copper or GI earth wires

a.	2.5 sq.mm.	16 SWG or 1.5sq.mm. Cu. PVC insulated
b.	4 sq.mm.	14 SWG or 2.5sq.mm. Cu. PVC insulated
c.	6 sq.mm.	12 SWG or 2.5sq.mm. Cu. PVC insulated
d.	10 sq.mm./ 16 sq.mm.	8 SWG or 4.0sq.mm. Cu. PVC insulated
e.	25 sq.mm. / 35 sq.mm.	6 SWG or 6.0sq.mm. Cu. PVC insulated

All Single phase wiring have one run of earth wire and three phase wiring shall be provided with two runs of earth wires.

1.4 PRECAUTIONS :

1.4.1 Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after passages of fault currents.

1.4.2 Joints shall be soldered, tinned and double rivertted in case of copper and joints shall be filed and doubled rivertted in case of GI. All the joints shall be mechanically, electrically, continuous and effective.

1.5 TESTING :

1.5.1 On the completion of the entire installation, the following tests shall be conducted.

a. Earth resistance of electrodes.
b. Earth loop impedance as per IS L 3043/NEC.

1.5.2 All meters, instruments and labour required for the tests shall be provided by the contractor. The results shall be submitted in triplicate to the engineer-in-charge for approval.

5.13 **Other Components**

5.13.1 Moulded Case Circuit Breaker (MCCB**)**

The MCCB (moulded case circuit breaker) shall conform to the latest IEC 947-2 & IEC 947-3– 1989. The Service Short Circuit Breaking Capacity (Ics at 415VAC) should be as specified at the required level.
The MCCB shall be Current Limiting type and comprise of Quick Make – Break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the Tripping unit, contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCBs shall be capable of defined Variable overload adjustment. All MCCBs rated 200Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall over ride all other commands. The MCCB shall employ maintenance free double break contact system to minimize the let thru energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let thru energy curves. The MCCB shall not be restricted to Line/ Load connections.

The handle position shall give positive indication of 'ON', 'OFF'' or 'Tripped' thus qualifying to Disconnection as per the IEC947-3 indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection . **MCCBs controlling motors should be suitable for motor protection.**

5.13.2 Miniature Circuit Breaker (MCB**)**

Miniature Circuit Breaker shall comply with IEC898 – 1996. The Miniature circuit breakers (MCB) shall be quick make and break type for 230 / 415 VAC 50 Hz application with thermal magnetic releases for over current and short circuit protection. The Breaking capacity shall not be less than 10 KA at 415VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Energy Class–3). MCBs shall be classified (B,C,D as per the IEC 898 standards) as per their Tripping characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection . All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

5.13.3 Switch Fuse Units

a. High rupturing capacity fuse (HRC Fuse) shall carry ISI mark on it and shall be rated for duty as indicated on the drawing/schedule of Quantities. The rating of HRC fuse shall be as per the rating of motor/equipment. The rating of fuse shall be selected so as to provide discrimination.

a. The switch fuse units shall be three pole double break action with switched neutral. All switch fuse units shall be provided with the hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is 'ON' position and also to prevent energizing the switch when the door is not properly secured. All contacts shall be silver plated and alive parts shall be shrouded. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall have rupturing capacity of not less than 31 MVA at 415 volts. All switch fuse units shall be provided with visible indicators to show that they are in 'ON or OFF' position. All switch units shall be of AC-23 category.

5.13.4 Motor Starter

The Motor Starter shall be a combination starter consisting of motor protection circuit breaker and suitable contactor for remote starting.

a. Motor protection circuit breaker

The motor protection circuit breaker must comply to the latest IEC 947-4 and the corresponding IS 13947-4. The motor protection circuit breaker should be suitable for

AC3 duty at 415V. The motor protection circuit breaker should offer built in coordinated overload and short circuit protection. The motor protection circuit breaker should have built in single phase / phase loss preventor. The motor protection circuit breaker should offer separate ON/OFF indication and Fault signal contacts which should be wired onto the panel for indication. The motor protection circuit breaker should offer Type 2 coordination along with the contactor.

b. Contactors

The contactor should be suitable for AC3 duty at 415V and should comply to the latest IEC 947-4 and the corresponding IS 13947-4. The contactor should have minimum 10 x IE rated making / breaking capacity as per the latest standard. The same should be suitable for Type 2 coordination along with motor protection circuit breaker. The contactor should have Class H insulation for the coil to prevent heating and to facilitate frequent start / stop function without heating.

5.13.5 Earth Leakage CB/ Residual Current CB

The ELCB/RCCB shall comply with IEC 1008. The ELCB/RCCB shall current operated independent of the line voltage. ELCB / RCCB shall work on the principle of core balance transformer. The ELCB / RCCB shall be rated for current sensitivity of a Min of 30mA and a Max of 300mA at 240 / 415VAC.The terminals shall be protected against finger contact to IP20 degree of protection. The ELCB / RCCB shall have a minimum of 20,000 electrical operations.

Testing Provision for the Earth Leakage Circuit Breaker

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB and the operating handle shall move to the "OFF" position.

5.13.6 Air Circuit Breaker (ACB) **:**

The ACB shall conform to IEC 947-2-1989 & IS 13947 (Part –2). The Service Short Circuit Breaking Capacity shall be as specified and equal to the Short circuit Withstand Values. The ACB shall be provided for controlling the in coming supply feeder or as required and specified in schedule. Shall be available in 3 or 4 pole with modular construction, fixed or draw out, manually or electrically operated versions as specified. ACB shall be capable of providing short circuit, overload and earth fault protection (in absolute values) if required, through microprocessor based control unit sensing the true RMS values to ensure accurate measurement meeting the EMI/ EMC requirement as per the standard.

The breaker should have 3 distinct positions – SERVICE /TEST / ISOLATED within the cubicle. It should be possible to withdraw the breaker for testing with the door closed. Safety interlock must be provided to prevent the ACB from falling out in a fully withdrawn position. The ACB shall be provided with a door interlock. The contacts should be copper and silver plated only

with a feature of contact wear inspection indicating the life of the contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and inaccessibility to live parts.

All electrical closing of breaker should be with Electrical motor wound stored energy spring closing mechanism with Mechanical indicator to provide. ON/ OFF status of ACB.

For all ACBs the Operating handle should be provided for charging the spring in continuous action. The spring shall be released with ON / OFF push button command in one operation at the correct speed independent of operator speed. A direct mechanical coupling should indicate the ACB in ON or OFF position thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. One set of NO / NC potential free contacts to be provided for operation on Building Management System. All accessories like shunt, under voltage motorized mechanism etc shall be front mounted, requiring no adjustments and can be fitted at site.

The manufacturer shall provide details of opening time and deration with temperature to ensure discrimination and proper selection for feeders protection. All ACBs of 4000 A and above shall be a single ACB and Tandom operated will not be acceptable.

5.13.7 SAFETY FEATURES :

1. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
2. It should not be possible to interchange two circuit breakers of two different thermal ratings.
3. There should be a provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism.
4. Earthing bolts must be provided on the cradle or body of fixed ACB. Arc Chute covers should be provided wherever necessary.
5. The incoming panel accommodating ACB shall be provided with indicating lamps for ON- OFF positions, voltmeter and ammeter of size not less than 96mm x 96mm, selector switches, fuses for potential circuit and current transformers.
6. It should be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.

5.13.8 PROTECTIONS

1. The Electro magnetic and thermal release or Microprocessor based unit should be provided on circuit breaker for short circuit , over current and earth fault protection with adjustable settings.
2. Specific LED indications should be provided for over current and earth fault operation.
3. Relays should be CT operated through shunt trip for short circuit and earth fault protection.
4. Under voltage relays should be provided.
5. Minimum 6 NO and 6 NC auxiliary contacts shall be provided on each breaker. The contacts shall be rated 5 Amps.
6. Rated insulation voltage is 1000 volts AC.

5.13.9 Push Button Stations

Push button stations shall be provided for manual Start & Stop of equipment. Push button shall have ON & OFF indicating lamp in red and green colour. Push button shall be fabricated in 16 gauge sheet steel.

These station shall be factory fabricated. ON & OFF operations shall be carried out from front without opening the door. One set of NO & NC contact shall be provided in push button station as spare.

5.13.10 Toggle Switch

The toggle switch shall be of minimum 5 Amps rating.

5.13.11 Thermal Overload

The relay shall be factory calibrated, sealed and suitable for an ambient temperature at site or 50 deg C whichever is higher.

It should provide reliable and accurate protection against overload, single phasing and locked rotor conditions. Relays are to be provided with :

(a) Trip alarm contact
(b) Trip lever for testing
(c) Auto reset facility

Rated insulation voltage shall be 660 volts AC.

5.14 **Instruments**

a. General :

The specifications hereinafter laid down shall cover all the meters and instruments.

b. **Instrument Transformers**

(i). Current Transformers

Current transformers shall be in conformity with IS : 2705 (Part I,II,III & IV) in all respects . All current transformers used for medium voltage applications shall be rated for 1 KV. However, the rated secondary current shall be 5 A unless otherwise specified. The acceptable minimum class of various applications shall be as given below :

Measuring : Class 0.5 to 1

Protection : Class 10 p

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identifications of poles. Current transformers shall be provided with earthing terminals, for earthing chasis frame work and fixed part of the metal casing (If any). Each CT shall be provided with rating plate indicating the following :

i. Name and make
ii. Serial Number
iii. Transformation Ratio
iv. Rated Burden
v. Rated Voltage
vi. Accuracy Class

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CT's shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat & clean manner.

c. Potential Transformers

Potential transformers shall be provided if specifically called for potential transformers shall comply with the requirements of IS : (Part I,II,III) in all respects.

d. **Measuring Instruments**

i. General

Direct reading electrical instruments shall be in conformity with IEC-51, BS:89 or IS :1248. The accuracy of direct reading shall be 1.0 for voltmeters and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The meters shall be suitable for continuous operation between -10 deg C and +50 deg C. All meters shall be of flush mounting type with square pattern. The meter shall be enclosed in a dust tight housing . The meters shall be provided with white dials and black scale markings. The pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside.

ii. Ammeters

Ammeters shall be of moving-iron type. The moving part assembly shall be with jewel bearings. The jewel bearing shall be mounted on a spring to prevent

damage to pivot due to vibrations and shocks. The ammeters shall be manufactured and calibrated as per the latest edition of IS: 1248 or BS:89. Ammeters shall be instrument transformer operated, and shall be suitable for 5 A secondary.

Upto 30 Amps the ammeter shall be direct operated without current transformer on one phase only. Beyond 30 Amps the ammeter shall be CT operated with selector switch.

iii. Voltmeters

Voltmeters shall be of moving-iron type. The range for 400 volts, 3 phase voltmeters shall be 0 to 500 volts. The voltmeter shall be provided with protection fuse of suitable capacity.

5.15 **Earthing**

a. General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS-3043. All metal conduits, trunking, cable sheathes, switchgear, distribution boards and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to control panel. Earthing shall meet the requirements of IER 1956.

b. Earthing Conductor

All earthing conductors shall be of high conductivity copper as specified and shall be protected against mechanical damage and corrosion. The size of the earth conductor shall not be less than half of the largest size of the current carrying conductor. The connection of the earth continuity conductor of earth and earth electrodes shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cable trays or conduits and cables by using suitable clamps made of non ferrous metals. Incoming power supply along with earthing upto MCC/AHU control panel shall be provided by other agency. The panel shall be earthed to building main earthing. The motor shall be double earthed to the panel.

The earthing shall be done with wires/flat as under :

S.No.	Equipment	Size of Earth	
Wire/Strip GI		Copper	
01.	Motors Upto 5 HP	2 Nos 8 SWG	2 Nos. 14 SWG
02.	Motors Upto 15 Hp	2 Nos 8 SWG	2 Nos 12 SWG
03.	Motors Upto 30 HP	2 Nos 4 SWG	2 Nos. 8 SWG
04.	Motors Upto 50 HP	2 Nos 25x6mm Flat	2 Nos. 4 SWG

05.	Motors above 50 HP	2 Nos 32x6mm Flat.	2 Nos. 25x3mm

Packaged unit electrical panel shall generally be wall mounted type. Above stated specifications shall also stand good where applicable. The packaged unit motor shall be double earthed with two independent earth conductors as per the Indian Electricity Rules & Regulations-1956.

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PREAMBLE TO BILL OF QUANTITY

1. All equipment described hereafter shall be in accordance with the specifications.

2. All equipment shall be selected and installed for the lowest operating noise level.

3. Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Architects , procurement of equipment, transportation, shipping, payment of all taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components and warranty obligations for the individual equipment.

4. Installation of various equipment shall include all material and labour associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting & anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.

5. Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and sound power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.

6. Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.

7. Testing and commissioning shall include furnishing all labour, materials, equipment, instruments and incidentals necessary for complete testing of each component as per the specifications & manufacturer's recommendations, submission of test results to the Owners/Architects, obtaining their approval and submission of necessary completion documents & drawings. Providing minor dressing of walls and floor, providing and installing pipe sleeves as required and treatment to pipes as per the specifications.

8. All piping should be installed conforming to the relevant Indian Standards, approved shop drawings and the specifications. All refrigerant piping should be tested as per the specifications.

9. Piping installation should include all costs towards supplying and fixing of pipes and fittings (elbows, tees, reducers) cutting, threading, joining, welding, soldering and affecting connections are required, providing non- hardening sealing material as well as rubber gaskets for screwed flanges, providing and installing adequate number of clamps, hangers, saddles, brackets, rawl plugs and other accessories for pipe supports, providing minor dressing of walls and floor, providing and installing pipe sleeves as required and treatment to pipes as per the specifications.

10. After completion of the installation, the entire piping system shall be tested for leak in accordance with the specifications.

11. All ducts shall be fabricated and installed conforming to the relevant Indian Standards, approved shop drawings and the specifications.

12. Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, distribution grids within the ducts in position extruded aluminium hardware fittings such as handles thunder bolts hinges, factory fabricated access door and providing , installing , MS hangers with dash fasteners, foam rubber insertions, nuts, bolts and screws as required. Making all joints air tight using rubber insertions in addition multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flow. All primer coated MS hangers, dampers, base frames etc. shall be painted with black enamel paint.

13. Grilles and diffusers shall be provided with a soft continuous rubber gaskets between their periphery and the surface on which these have to be mounted.

14. Grilles and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved color. Aluminium grilles and diffusers shall be fabricated out of extruded aluminium sections.

15. After completion of the installation, the entire air distribution system shall be tested for leaks and balanced in accordance with the specifications.

16. All equipment and material to be supplied under this contract shall be conforming to the relevant latest Indian Standards and international standards as applicable.

17. Appropriate troughs in the suspended ceiling be provided for terminating duct collars for diffusers and grilles by other agencies to achieve desired interior finishes.

18. Contractor to verify the static pressure of various air handling units in accordance with the approved for construction shop drawings before selection of motor.

19. **Mode of Measurement**

The mode of measurement for the various items, unless otherwise specified, shall be as follows
:

19.1 Ducting

Payment for ducting shall be made on the basis of the external surface area of the ducting including all material and labour for installed duct.

The rates per Sft of the external surface shall include MS angle iron /GSS flanges, gaskets for joints, nuts & bolts, duct supports & hangers, vibration isolation pads or suspenders, dash fasteners, inspection doors, dampers, turning vanes, major hardwares such as thunder bolts, hinges, handles in extruded aluminium construction and any other item which will be required to complete the duct installation except external insulation and acoustic lining.

The external area shall be calculated by measuring the overall width and depth (including the corner joints) in the centre of the duct sections and overall length of each duct section from flange face incase of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections.

In case of taper pieces average width and depth will be worked out as follows :

W1 = width of small cross section
W2 = width of large cross section
D1 = depth of small cross section
D2 = depth of large cross section

$$\text{Average width} = \frac{W1 + W2}{2}$$

$$\text{Average depth} = \frac{D1 + D2}{2}$$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections fitted with angle iron flanges, otherwise at the bottom of the flange where flanges are of duct sheet.

For the circular pieces the diameter of the section mid-way between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface at the taper piece.

For the face length of taper piece shall be the mean of the lengths measured face to face from the centre of the width and depth of flanges.

For the special pieces like bends, branches, and tees etc. same principle of area measurement as for linear lengths shall be adopted except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature or angle of the piece.

19.2 Duct Insulation

This item is provided separately for various thickness and shall be paid for on area basis of un- insulated duct. The area of the duct to be insulated shall be measured before application of insulation.

Quantity on account of insulation applied over duct flanges shall not be extra. Quantity of insulation shall be similar to duct quantity.

19.3 Grilles & Diffusers

All extruded aluminium grilles and diffusers shall be paid on the basis of actual measurement at site on area basis using neck size as base for diffusers having outer size less than 600mm. Minimum payable quantity for grilles & diffusers shall be 0.1Sq.m. For 600mm x600mm size diffusers being installed in grid ceiling shall be counted at site and payment shall be made on unit basis.

19.4 Refrigerant Piping

Payment for refrigerant piping and condensate drain piping shall be made on the basis of linear measurement including all material and labor for installed pipes. The linear rate per meter/feet for each nominal diameter shall include all pipe fittings except refnet joints, pipe supports & hangers, vibration isolation arrangement, closed cell elastomeric insulation material and any other item required to complete the pipe installation except valves of any kind and strainers.

19.5 Refnet Joints

Payment shall be made on unit basis.

20. All quantities reflected in the schedule are for contractor's guidance only.

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GUARANTEE PROFORMA FOR HVAC INSTALLATION

Owner : **Bank**

Location : Delhi

1. The Contractor shall furnish the following guarantee:

"We warrant that everything supplied by us including all components fitted into the equipment manufactured by others also, shall be in all respects free from all defects and faults in material, workmanship and manufacture and shall be of the highest grade and quality to acceptable standards for all materials of the type ordered and shall be in full conformity with all the specifications, drawings or samples if any and we shall be fully responsible for its efficient performance. This guarantee shall survive inspection for acceptance and payment for the equipment and installation, but shall expire (except in respect of the complaints notified to us) 12 months from the date of issue of completion certificate by the Architect/Consultants. The complaints, workmanship, manufacturer or performance of any of the equipment or part/parts thereof shall be notified by fax within 12 months from the date of issue of such completion certificate".

2. The Contractor shall replace such of these parts which require replacement under these conditions free of cost, charge and expenses to the purchaser. In addition, the Contractor shall be responsible for a period of 12 months from the date of issue of completion certificate for any defect that may develop or appear under the conditions provided by the Contractor or use thereof arising from faulty material design or workmanship in the equivalent or any part thereof or faulty installation of the equipment by the Contractor but not otherwise and shall correct such defects within one week from the date of notification at his own cost when called upon to do so by the purchaser who shall state in writing in what respect the portion is faulty.

3. Any faulty component replaced or renewed under the clause shall also be guaranteed for a period of six months from the date of such replacement or removal of until the end of the above mentioned period whichever is later.

4. If defects are not rectified within a reasonable time as mentioned in the written notice, the Project Managers/Architects/Owners shall proceed to do so at the Contractor's risk and cost without prejudice to any other right thereof.

SIGNATURE AND STAMP OF THE CONTRACTOR

DATE :

SPECIFICATIONS

- All the works specified and provided for in the tender/ schedule and drawing or which may be required to be done in order to perform and complete any part there of shall be executed in accordance with the technical specification, workmanship, quality control, as prescribed whether enclosed/ not enclosed in this document, in the specification & codes, with up to date amendments, in the following order:-

  a) CPWD/ DSR

  b) IS (BIS) Codes

- All works under this contract (wherever grey cement is used) have to be executed in OPC.

- The quantities given in the tender are approximate. However, the payment shall be made on the basis of actual measurements taken on site and in conformity with CPWD Specification and BIS Codes. It is clarified that all quantities are subject to change and no claims whatsoever on this behalf shall be entertained.

- All materials used in the works shall be of their respective kind and quality specified in the tender document or approved by the SBI and/ or Architect and shall comply strictly with the requirements of the latest specifications of CPWD and Indian Standard Codes.

- The work shall be executed and measured as per metric dimensions given in the Schedule of Quantities, Drawings etc. (FPS units wherever indicated are for guidance only).

Signature of Contractor & Seal

SPECIFICATIONS FOR SERVICES

- **General**

1.1 The drawings for services are diagrammatic but shall be followed as closely as actual construction permits. Any deviations from the drawings shall be in conformity with Consultantural and structural drawings. The dimensions designated by the manufacturers shall take precedence over the drawings.

- At completion of work the Contractor shall submit one set of tracings and two sets of prints of "As-Built-Drawings". These drawings shall, among others, include invert levels, pipe runs, diameters, location of valves, access panels, layout of equipment, piping connections and such other information for maintenance & future extensions. Guarantees given by manufacturers shall be assigned to the Employer along with names & addresses of manufacturers, suppliers and information about spare parts.
- All site test shall be carried out with prior intimation to the Bank Engineer / Consultant. All defects shall be rectified and tests conducted again to the satisfaction of the Bank Engineer / Consultant. In addition to the test required by the specifications, the Contractor shall also conduct tests required by the Consultant and by the Municipal or other Authorities.
- All work shall be executed by competent and licensed persons. The contractor shall maintain liaison with Municipal and other controlling Authorities. He shall obtain their approvals and certificates as required by the bye – laws at appropriate stages.
- No cutting / chasing shall be done in load bearing structural members without prior approval of the Asstt. Engineer. Sleeves and openings shall be provided during the progress of construction in preference to cutting at later date.
- The Consultant may require typical mock up(s) to be installed in advance for approval. Undamaged materials from the mock up shall be allowed to be reused in the work.
- Unless otherwise described in the item CI / SCI pipes and fittings shall be a spigot and socket type.
- G.I. pipe spouts shall be paid as per item of G.I. pipes (internal work). Cutting and making good is included. The free ends may be skew-cut.
- Wherever use of G.I. pipes is called for the same shall be medium class (class – B)
- **Materials :**

2.1 The materials shall conform to the specifications and in absence thereof to Indian Standards. The products should bear the ISI Mark.

2.2 The makes of materials for use in this work are broadly approved as per list given below. The Contractor shall, however, get particular makes and samples approved before ordering:

2.3 Notwithstanding any interim or final approval the Contractor remains responsible for satisfactory performance of all fittings & fixtures. The liability of the Contractor is not limited by any approval of the make of materials.

2.4 The item rate of mirror includes extra packing piece of AC plain sheet, where required due to off set between plaster & glazed tiles surface.

- **Testing**

- The sand cast iron soil, waste and vent pipes and fittings including joints shall be tested by pumping smoke into the pipe at the lowest end.
- All G.I pipes and fittings including joints shall be tested to hydraulic pressure of 6 kg / cm2 (60 meters) avoiding water hammer. The test pump having been stopped the test pressure should maintain without loss for at least half an hour. The pipes and fittings shall be tested in sections as the work of laying proceeds keeping the joints exposed for inspection during the testing.
- All stone ware pipes shall be tested with water pressure of 1.5m head of water at the highest point of the section under test.

SAFETY CODE

- First aid appliances including adequate supply of sterilised dressing and cotton wool shall be kept in a readily accessible place.
- An injured person shall be taken to a public hospital without loss of time, in cases where the injury necessitates hospitalization.
- Suitable and strong scaffolds should be provided for workmen for all works that cannot safely be done from the ground.
- No portable single ladder shall be over 8 meters in length. The width between the side rails shall not be less than 30 cm (Clear) and the distance between two adjacent rungs shall not be more than 30 cm. When a ladder is used an extra mazdoor shall be engaged for holding ladder.
- Every opening in the floor of a building or in a working platform be provided with suitable means to prevent to fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one meter.
- No floor, roof or other part of the structure shall be so overloaded with debris or materials as to render it unsafe.
- Workers employed on mixing and handling material such as asphalt, cement mortar or concrete and lime mortar shall be provided with protective footwear and rubber hand-gloves.
- Those engaged in welding works shall be provided with welder's protective eye-shields and gloves.
- I) No paint containing leads or lead products shall be used except in the form of paste or readymade paint.

  ii) The workers should supply suitable facemasks for use when the paint is applied in the form of spray or surface having lead paint dry rubbed and scrapped.
- Overalls shall be supplied by the contractor to the painters and adequate facilities shall be provided to enable the working painters to wash during the periods of cessation of work.
- Hoisting machines and tackle used in the works, including their attachments, anchorage and supports shall be in perfect condition.
- The ropes used in hoisting or lowering material or as a means of suspension shall be of durable quality and adequate strength and free from defects.

PROFORMA FOR RUNNING ACCOUNT BILLS

C E R T I F I C A T E

The measurements on the basis of which the above entries for the Running Bill_____ were made have been taken jointly on _____and are recorded at pages _____of Measurement BookNo._____.

Date & Signature of Contractor.	Date & Signature of Consultant's Representative (Seal).	Date & Signature of Site Engineer

The work recorded in the above-mentioned measurements has been done at the site satisfactorily as per tender drawings, conditions and specifications.

CONSULTANT **SITE ENGINEER / BANK'sENGINEER**

RUNNING A/C BILL

Name of Contractor/Agency: _____
Name of Work: _____
Sr. No. of this Bill: _____
No. and Date of Previous Bill. _____
Reference to Agreement No. _____
Date of Written Order to Commence._____
Date of Completion as per Agreement._____

Sr. No.	Item description	Unit	Rate (Rs.)	As per Tender		Upto Previous R/A Bill		Upto Date (Gross)		Present Bill		Remarks
				Qty.	Amt. (Rs.)	Qty.	Amt. (Rs.)	Qty.	Amt. (Rs.)	Qty.	Amt. (Rs.)	
1.	2.	3.	4.	5.		6.		7.		8.		9.

Note: 1. If Part Rate is allowed for any Item, it should be
Net value since
Indicated with reasons for allowing such a Rate.
Previous Bill.
2. If Adhoc Payment is made, it should be mentioned specifically.

Date &
Signature of Contractor.

PERFORMA FOR APPLICATION BY CONTRACTOR FOR EXTENSION OF TIME

- Name of the Contractor
- Name of the Work as given in the Agreement
- Agreement W O
- Tender Amount
- Date of Commencement of Work
- Period allowed for Completion as per Agreement
- Date of Completion as per Agreement
- Period for which Extension of Time has been given

Date **Month** **Year**

- 1st Extension vide Bank's Letter No
- 3rd Extension vide Bank's Letter No
- 3rd Extension vide Bank's Letter No

- Reasons for which extensions have been previously given (Copies of the previous applications should be attached)

    - Period for which extension is applied for and the reasons thereof including hindrances, time for extra work assigned, if any etc.

Signature of Contractor & Seal

PERFORMA OF HINDERANCE REGISTER

Name of Work : Date of State of Work :

Name of Contractor : Period of Completion :

Agreement No : Date of Completion :

Sr No	Nature of Hindrance	Date of occurrence of Hindrance	Date of which Hindrance was removed	Period of Hindrance	Signature SE / PE	Remarks
1	**2**	**3**	**4**	**5**	**6**	**7**

SE = Site Engineer **PE = Project Engineer**

ACCOUNT OF SECURED ADVANCE, IF ADMISSIBLE ON MATERIALS HELD AT SITE BY THE CONTRACTOR

No.	Item	Quantity	Unit	Amount	Remarks
1	2	3	4	5	6
Total Value of Materials at Site					
Secured Advance @……% of above Value					B
CERTIFIED (I) That the materials mentioned above have actually been brought by the contractor to the site of the work and no advance on any quantity of any of this item is outstanding on their security, (ii) that the materials are of imperishable nature and are all required by the contractor for use in the work in connection with the items for which rates of finished work have been agreed upon.					

Dated Signature of
Site Engineer
Preparing the Bill

Designation_____

Dated Signature of
Bank's Consultants

(Name of the Consultants)

_____

Dated signature of

Contractor

BILL OF QUANTITY

PREAMBLE:

TO BE READ ALONG WITH DRAWINGS.

1. RATES TO BE QUOTED BOTH IN FIGURES AND WORDS.
2. ALL PAGES TO BE SIGNED AND STAMPED BY THE TENDERER.
3. THE RATE OF THE ITEMS SHALL BE APPLICABLE FOR ANY FLOOR LEVEL/ ANY NUMBER OF FLOORS, OR ANY QUANTITY.
4. THE SPECIFICATION OF THE ITEMS SHALL BE AS PER LATEST INDIAN STANDARD CODES UNLESS OTHERWISE SPECIFIED.
5. ALL MATERIALS SHALL BE AS PER APPROVED LIST AND SHOULD BE OF Ist QUALITY UNLESS OTHERWISE SPECIFIED.
6. THE RATES ARE INCLUSIVE OF ALL DUTIES AND TAXES (EXCEPT GST) OF ALL GOVERNMENT, MUNICIPAL OR ANY OTHER STATUTORY BODY APPLICABLE FROM TIME TO TIME.
7. RATES SHALL BE FOR ITEMS COMPLETE IN ALL RESPECTS AS PER DRAWING, INSTRUCTIONS AND APPROVAL OF THE CONSULTANT/ BANK'S ENGINEER.
8. THE QUANTITIES ARE APPROXIMATE AND TENTATIVE WHICH MAY VARY DURING COURSE OF EXECUTION. THE RATES QUOTED AGAINST PARTICULAR ITEM SHALL NOT BE CHANGED WITH VARIATION IN QUANTITIES.
9. MAKING OF ANY CUTOUT / OPENING FOR ELECTRICAL / AIR – CONDITIONING WIRING / FITTING IN ANY OF THE ITEM OF FALSE CEILING, PARTITIONS, PANELING MASONRY WORK ETC. AND FINISHING EDGES JAMBS / CILLS / SOFFITS OF THE OPENING SHALL NOT BE PAID EXTRA.
10. THE TENDERER SHALL VISIT THE SITE AND SHALL SATISFY HIMSELF AS TO CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED. HE SHALL ALSO CHECK, ASCERTAIN THE LOCATIONS OF ANY EXISTING STRUCTURES OR EQUIPMENT OR ANY OTHER SITUATION WHICH MAY AFFECT THE WORK. NO EXTRA CLAIM AS A CONSEQUENCE OF IGNORANCE OR ON GROUND OF INSUFFICIENT DESCRIPTION WILL BE ALLOWED AT A LATER DATE.
11. THE QUOTED PRICE FOR ITEMS SHALL INCLUDE ALL ACCESSORIES, CONSUMMABLES ETC. AS REQUIRED TO MAKE THE ITEM COMPLETE IN ALL RESPECTS, COMPATIBLE WITH OTHER RELATED / ASSOCIATED ITEMS AND FULLY FUNCTIONAL.
12. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY ERROR, DIFFICULTY IN EXECUTION / DAMAGES INCURRED OWING TO DISCREPANCY IN DRAWINGS WHICH HAS BEEN OVERLOOKED BY HIM AND HAS NOT BEEN BROUGHT TO THE NOTICE OF THE CONSULTANT.
13. THERE ARE NUMBER OF ITEMS GIVEN IN THE TENDER WHERE IN BASIC RATES INCLUDING ALL TAXES EXPECTED HAS BEEN MENTIONED IN THE TENDER. THESE ITEMS SHALL BE PURCHASED BY THE CONTRACTOR FROM THE MARKET ONLY AFTER THE APPROVAL OF QUALITY AND RATES BY THE CONSULTANT.
14. ALL HIDDEN SURFACES OF BOARD / PLY / WOOD WORK TO BE PAINTED WITH ANTI BACTERIAL PAINT FROM NAV AIR INTERNATIONAL FR 881 (VIPER) (WHITE COLOUR AS PER MANUFACTURER'S SPECIFICATIONS ON WOOD / BOARD).
15. CONTRACTOR SHALL APPOINT TECHNICALLY QUALIFIED FULL TIME SITE SUPERVISOR TO MONITORING THE DAY TO DAY PROGRESS OF WORK AT SITE ON THEIR OWN COST.

(Refer Annexure /section in e-tender portal for detailed Bill of Quantities)

A) THE HVAC WORK IS TO BE GOT EXECUTED THROUGH BANK'S EMPANELLED ELECTRICAL VENDOR ONLY IF APPLICABLE

FOR DIFFERENT CATEGORIES OF WORKS, SEPARATE BILL TO BE SUBMITTED BY THE VENDOR CATEGORY WISE. THE L1 CONTRACTOR HAS TO ADVISE NAME OF THE BANK'S EMPANELLED ELECTRICAL/ AIR CONDITIONING / INTERIOR CONTRACTOR BEING ENGAGED BY THEM FOR THE SPECIFIED WORK IN WRITING BEFORE THE AWARD OF WORK IF APPLICABLE

AGREED AND ACCEPTED ALL THE TERMS & CONDITIONS.

SIGNATURE OF CONTRACTOR

DATE: **SEAL:**