

Vol - I: TENDER DOCUMENT

**Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works
for
SBI Life Insurance Company Ltd Regional Office, Chennai**

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FIRM DETAILS

Name of Firm	
Address of Firm with contact Phone and Mobile No:	
Local Address of Firm with contact Phone and Mobile no	
Email Id:	
PAN No:	
TAN No:	
TIN No:	
GST No:	
ESI / PF Registration No :	
Any other Registration details relevant to the Contract	
Name of Bank with address:	
Branch Code:	
Type of Account:	
Account No:	
9 Digit IFS Code no:	

Note: In order to ensure immediate credit of payment made by the SBI Life, it is preferable to have the Account with SBI Life.

Date:

**Signature of Tenderer with
seal**

Name of the Work: Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai

CHECK LIST

S. No.	Details	Please tick
1	Covering Letter	<input type="checkbox"/>
2	EMD enclosed to an amount of Rs..... vide DD no : ----- ----- dated-----drawn in the Bank.....	<input type="checkbox"/>
3	Duly Filled in Company details	<input type="checkbox"/>
4	Duly filled in Annexure I – Declaration.	<input type="checkbox"/>
5	Duly Signed in Annexure II – Letter of Submission from Contractors.	<input type="checkbox"/>
6	Have read fully the Appendix A and Appendix B (Salient conditions of Contract)	<input type="checkbox"/>
7	Have read fully the Instruction to Tenderers, General Conditions of Contract, Special Conditions of Contract etc.	<input type="checkbox"/>
8	Part I – Envelope “TB” (Technical Bid) contain Tender document, Earnest Money Deposit (EMD), - submitted in a separate cover	<input type="checkbox"/>
9	Part II – Envelope "PB" (Price Bid) contain Bill of Quantities in duplicate, Drawings – submitted in a separate cover	<input type="checkbox"/>
10	All pages / documents are stamped and signed by the authorized signatory	<input type="checkbox"/>
11	GST Registration copy enclosed	<input type="checkbox"/>

Signature of Tenderer with seal

SBI Life Insurance Company Ltd Regional Office, Chennai
Notice Inviting Tenders
(NIT No 467 / 484 dated 15.11.2017)

SBI Life Insurance Company Ltd invites sealed tenders from the contractors for the following work. The details of tenders are under:		
1.	Name of work	Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai
2.	Time allowed for completion	75 Days from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later
3.	Earnest Money Deposit (EMD)	Rs.2,00,000/- by DD in favour of SBI Life Insurance Company Ltd, Regional Office, Chennai
4.	Security Deposit	5 % of total contract value (Inclusive of EMD & ISD). 50 % of the security deposit shall be released after virtual completion of the works. Balance 50 % after successful completion of the Defect Liability Period
5.	Cost of Tender document	Rs.3,000/-
6.	Address at which the tenders are to be submitted	SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6
7.	Date of Tender Issue	17/11/2017 to 22/11/2017 at M/s. Pithavadian & Partners, 10, Murugappa Road, Kotturpuram, Chennai - 600 085 Contractor advised to collect the Tender so as as possible. Don't wait till the last date of receiving Tender Document. If courier is delayed SBI Life will not be responsible.
8.	Pre-Bid Meeting	28/11/2017 at 3.00PM at SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6
9.	Last date and time of receipt of tenders	05/12/2017 by 14.30 Hrs.
10.	Date and time of opening of technical Bid	05/12/2017 at 15.00 Hrs
11.	Date and time of opening of Price Bid	05/12/2017 at 17.00 Hrs
12.	Place of opening of tender	SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6
13.	Defect Liability Period	6 Months
14.	Validity of offer	90 days from the date of opening of Price Bid
15.	Liquidated damages	Rs.1,00,000/- per week subject to a maximum of 10 % of the total contract value.
16.	Value of interim certificate for bill	1/4 of the total Contract value

17.	Eligibility Criteria	SBI / SBI Life Empaneled Contractors Only. Similar nature of Min one work - Rs.1.5Crore Similar nature of Min two work - Rs.1.0 Crore
Tenders are to be submitted in sealed covers super scribed Tender for “Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai” In case the date of opening is declared as a holiday, the tender will be opened on next working day at the same time.		
SBI Life Insurance Company Ltd has the right to accept / reject any or all tenders without assigning any reasons.		
For and behalf of SBI Life Insurance Company Ltd		For Contractors

NOTICE INVITING TENDER

To

Dear Sir/s,

SUB: Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai

.....

1. Tenders are hereby invited on behalf of The Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6 for the above work.
2. The Contract documents consisting of Notice Inviting Tender, Instructions to the Tenderers, General Conditions of Contract, Special Conditions of Contract, Special Conditions, Preamble, List of Approved Makes, Bills of quantities and Working Drawings etc., can be had from our office on payment of a non-refundable sum of **Rs.3000/-** towards printing & stationary charges as Tender document fee, by cash or DD.
3. Please fill in the Bills of Quantities **in duplicate** and submit your Tender in all respects as indicated on Instructions to Tenderers, on or before **14.30 hours** on **05/12/2017** in a sealed single cover super scribed "**Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai**" If there is any covering letter this must also be in duplicate.
4. The Tender is to be submitted in two parts, each in a different sealed **ENVELOPE** duly marked. The envelope for **Part I** shall be marked "**TB**" (**Technical Bid**) on the outside and that for **Part II** shall be marked "**PB**" (**Price Bid**). Part I should contain only the variation from the Technical and Commercial stipulation and conditions of the Tender & along with the Earnest Money Deposit and Part II nothing but the price bid with no conditions.
 - a. **Part I – Envelope:** To contain Tender document Earnest Money Deposit (EMD),
 - b. **Part II – Envelope:** To contain Bill of Quantities, Drawing in duplicate,
5. Envelope for **Part I-Technical Bid** will be opened in the office of The Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6, at **15.00 hours** on **05/12/2017** and **Price Bid will be opened on 17.00 hours on 05/12/2017** in the presence of the Tenderers/ authorized representative who may choose to be present. Tenderers could depute one person only for the Tender opening who is duly authorized and they should produce an authorization letter.
6. The Terms/ Conditions if any stipulated by the Tenderers in envelope for **Part I-TB** will be evaluated by the Employer and Architects.

7. If there is no change in their original price bid, the Tenderers should send a letter to that effect in **sealed envelope part III**. If any Tenderer does not respond to the letter issued (or) delays furnishing replies without valid reasons, the SBI Life shall have the right / authority to either ignore their offer and their Envelope Part II Price Bid shall be returned to them un opened.
8. There will be no references to the Tenderers other than lowest whose Tender is being considered for acceptance. On opening the envelope **Part II - PB** on the day to be intimated, the Tender value will be increased/ decreased by loading the financial implications of the Terms/ Conditions, evaluated already as above. The Percentage, if any, given in the Envelope Part III will be loaded to the price in Envelope Part II and the Tenders will be evaluated accordingly. At the time of Tender opening only the total amount will be read out twice. No break up figures or other information will be given to the Tenderers.
9. Tender received after the time above stipulated will be summarily rejected and no extension of time will normally be allowed for submission of the Tender.
10. The time of completion of work is **75 Days** from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later.
11. Every Tender shall be accompanied by an **Earnest Money Deposit for Rs.2,00,000/- (Rupees Two Lakhs Only)** in the form of Demand Draft drawn in the favour of, **SBI Life Insurance Company Ltd, Regional Office, Chennai**. The Tender not accompanied by such EMD are liable to be rejected. (E.M.D in any other form will not be accepted).
12. The EMD & ISD will be retained in the case of the successful Tenderer as part of the security deposit for the due fulfillment of the Contract and will be refunded without any interest thereon to the unsuccessful Tenderers within 30 days of award of Contract.
13. The Tenderer will submit their Tender after carefully examining the whole of the Tender documents and the conditions of Tender, and of Contract, Appendix to the Conditions of Contract, the drawings and specifications, the bill of quantities etc. and after inspecting the site. The Tenderer will have to quote for all the sections in the Tender document.
14. Canvassing in connection with Tenders is strictly prohibited and Tender submitted by the Contractors who resort to canvassing are liable to be rejected.
15. Tenders **not fulfilling any of the conditions prescribed or which are incomplete are liable to be rejected**. SBI Life reserve the right to accept or reject any tender either in whole or in part without assigning for any reason for doing so and do not bind them to accept the lowest or any tender.
16. All pages of the Tender documents should be signed and stamp affixed by the Tenderer.
17. SBI Life also reserves the right to divide and distribute the work, floor wise/ section wise/ item wise and trade wise and this may please be noted by the Tenderer. In such cases the decision will be solely at the discretion of SBI Life in consultation with Architects M/s. Pithavadian & Partners, Chennai, including that of assignment of works. Tenderers are advised to ensure strict observance of commercial aspect of this Tender.

18. The successful Tenderer shall furnish a list of his relatives working with the Employer along with their designations and addresses.
19. No employee of the Employer is allowed to work as a Contractor for a period of 2 years from his retirement from the service under the employer without the previous permission of the Employer. The Contract (awarded) is liable to be cancelled if either the Contractor or any of his Employees is found at any time to be such a person who had not obtained the permission, as afore said before submission of Tender, or engagement in the Contractor service.
20. **Defects liability Period:** 6 months from the date of 'Virtual Completion' certified by the Client/ Architect.
21. The successful Tenderer will enter in to Agreement with SBI Life as per the standard format within 15 days from the date of receipt of work order (or) the date of handing over the site whichever is later.
22. This Notice Inviting Tenders, Instructions to the Tenderers, General Conditions of Contract, Special Conditions of Contract, and Safety Code and the duly completed will inter alia form part of the Agreement to be executed by the successful Tenderer with the Employer.

Yours faithfully,

**PARTNER,
PITHAVADIAN AND PARTNERS.**

Signature of the Tenderer with seal:

Address:

Date:

APPENDIX-A

- 1 Address at which the Tenders are to be submitted : The Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai – 6
- 2 Last date of submission of Tender : 05/12/2017 at 14.30hrs
- 3 Date and time of opening of Technical Bid : 05/12/2017 at 15.00hrs
- 4 Date and time of opening of Price Bid : 05/12/2017 at 17.00hrs
- 4 Place of Opening Tender : SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai – 6
- 5 Earnest Money Deposit : Rs.2,00,000/- by DD in favour of SBI Life Insurance Company Ltd, Regional Office, Chennai
- 6 Initial Security Deposit (ISD) : Sum equivalent to 2% of Contract value include EMD
- 7 Tender rate : inclusive of materials, labour, wages, fixtures, transportation, installation, all taxes (**excluding GST**), wastages, Octroi, machinery, temporary works such as scaffolding, cleaning, overheads, profit, statutory expenses, incidental charges and all related expenses to complete the work
- 8 Security Deposit / Retention Money : 5 % of total contract value (Inclusive of EMD & ISD). 50 % of the security deposit shall be released after virtual completion of the works. Balance 50 % after successful completion of the Defect Liability Period
- 9 Liquidated damages : Rs.1,00,000/- per week subject to a maximum of 10 % of the total contract value.
- 10 Time of Completion : The time of completion of work is **75 Days** from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later
- 11 Validity of Tender : 90 days from the date of opening of Price Bid

12 Certificate of Payment
(Ref: Clause 19 & 35 of General Conditions of Contract)

: **Interior Works**

- i. Interim bills will be paid when the approximate value of the work done is 1/4 of the total Contract value.
- ii. The minimum interval between two such bills shall be 15 days.
- iii. SBI LIFE will make the payment of Bills within 10 days from the date of payment certificate issued by the Architect/ Consultant provided the bills are submitted in standard format with MBs.
- iv. Contractor should submit the interim bills in the prescribed format only after taking actual measurements for the completed work and properly recorded in the M-Books.
- v. No advance in any form shall be payable against any material brought to site.
- vi. The final bill may be submitted to the Architects with in a period of 15 days from the date of Virtual Completion certified by Architects.
- vii. The final bill shall be settled by SBI Life with in a period of one month from the date of issue of certificate by the Architects provided there is no dispute in respect of rates and quality/ Workmanship.

Date:

Signature of Tenderer with seal

Reimbursement of GST will be made only on submission of proper GST invoice as per applicable GST provision. The contractor should comply with the following;

- Contractor should have GST Registration Number
- Invoice should specifically/separately disclose the amount of GST levied at applicable rate as per GST provision
- In case of Correction in the bills after scrutiny, contractor should submit fresh bills for payment
- Contractor should timely file his GST return in accordance with GST provisions to enable the bank to claim the credit of GST paid to the contractor
- Bank will withhold max. to the extent of amount paid towards GST from each invoice and the same will be released after availing CENVAT credit by the bank. The bank would be availing CENVAT credit of GST component after the contractor properly files the GST return in respect of sales/service provided to the bank
- Income Tax will be deducted at source as per Govt. Guidelines.

APPENDIX – B

Salient Conditions of Contract

1. The successful Contractors have to furnish a detailed **PERT CHART / BAR CHART** indicating their schedule programme for all the major activities within 15 days from the date of written order to commence the work. This **PERT CHART / BAR CHART** will be referred for during the progress of the work to establish the periodical land marks of achievement of work. If necessary the revised **PERT CHART / BAR CHART** based on the revised scope of work have to be submitted by the Contractor.
2. The successful Tenderer should **appoint** a **Project Engineer** who is well acquainted with the Interior, Electrical, HVAC, Fire Alarm, Sprinkler system nature of work and handle the interior works. He should be in a position to answer for any clarification during site visit by Architect / Client Engineers (**Ref: Clause No.46 of General Conditions of Contract**).
3. In case the Tenderer engage their associate agencies for the electrical work, they should also possess the same license and the Tenderer should furnish the **name of such Agency** along with the copy of license in the **Tender Part I-TB**. In case the successful Tenderer would change such associate Agency for electrical during the course of execution, for any reason and it should be intimated in prior by writing to the Architect/ Client and an approval from the Architect / Client has to be obtained before any such act.
4. The associate agencies to be engaged by the Tenderer to carry out the specialist job like Electrical should have rich or similar experience in the respective field and they have done the similar works in Govt. / Semi Govt. /Banks / Financial institutions etc. The Tenderer should furnish the name of such Agencies along with their experience certificate in Tender Part I-TB.
5. The Tenderers after collecting Tender document should thoroughly study the relevant Interior, electrical drawings in relation with BOQ and bring to notice of abnormality, if any, to the Architects prior to submission of Tender.
6. Contractors are expected to strictly adhere to the **labour laws** in force from time to time by Central Government. The necessary records should be maintained at site and an amenity to the labours has to be made available at site as per law. The labours should be paid the salary in time as per the minimum wage act. The labour license shall also to be obtained from the authorities concerned.
7. After completion of work the Contractor should prepare **As built drawings** of each trade such as interior work after modifying the actual drawings issued by the Architect where ever the changes made by SBI LIFE/ Architect/ Consultant in the form of three sets of hard copy in colour and one soft copy.
8. The successful Tenderer awarded with the interior work assumes overall responsibilities and are solely responsible for co-ordination, execution of works by engaging their associate agencies for Electrical Installation works and extracting the works from them as per specification within the time frame to the satisfaction of Bank/ Architect as per Tender conditions. Any dispute if arise among them to be sorted out / settled at their level. The successful Tenderer is the sole representative for whole interior work and they/ he is liable for any clauses of this Tender.

9. If the interior Contractor are under liquidity crisis or in unpredictable financial crunches or in any other problems and by which the works are stalled due to non payment for the completed works to the Associate agencies engaged by them and the interior Contractor are not in a position to progress the work further, in the interest and earlier completion of the work SBI Life have every right to make direct payment to such already declared Associate agencies with written consent of the principle interior Contractor. In that event the amount paid to the Associate agencies shall be adjusted while making the actual payment as per the relevant clauses to the interior Contractors.
10. Necessary insurance policies such as **CAR policy/** Workmen's Compensation, Third Party liability to be taken before commencing the work and the original policies to be deposited with Bank.
11. Necessary Labour License to be taken before commencement of work.
12. SBI Life will **not pay any mobilization advance/** material advance and there will not be any escalation for the work.
13. No deviation will be allowed in the material specified.
14. The Tenderer is required to inspect the Site and obtain for himself on his own responsibility and at his own expense all necessary information and particulars to enable him to submit a proper Tender.
15. The Contractor at site verify the dimensions shown in the drawings before he takes up actual manufacture of the several items, making allowances for the actual dimensions that prevail at site.
16. The drawings, specifications and the bills of quantities, forming part of the Contract are explanatory of and are complementary to one another, representing together the works/ installations to be carried out.
17. If neither the drawings nor the specifications nor the accepted bills of quantities include any part/ parts the intention to include which is never the less clearly to be inferred and which are obviously necessary for the proper completion of the works/ installations, all such parts shall be supplied and executed by the Contractor at no extra charge.
18. Anything contained in one or another of (a) the drawings (b) the specifications and (c) the accepted bills of quantities and not found in the other will be equally binding as if contained in each of them.
19. The work will be done strictly in accordance with specification and drawings and as instructed the Architects/ Client.
20. The descriptions in the bills of quantities are brief and have been compiled as correctly as possible but are not meant to be exhaustive.
21. Laminate shall be of approved quality, make, and colour and shall be fixed with approved adhesive. Unless otherwise specified, laminate should be 1.00 mm thick for table top/ cupboards top, partitions, cupboard shutters and all vertical surfaces.
22. Unless otherwise specified:
 - a. All concealed faces of ply and CW should be painted with one coat of wood preservative paint.

- b. Inner faces of cupboards to be finished with 0.8mm thick laminate of approved colour and shade.
 - c. Table drawer inside should be finished with 0.8mm thick laminate of approved colour and shade.
 - d. All exposed faces of teakwood beading/ steam beech lipping/ moulding should be melamine polished as directed by the Client/ Architect.
 - e. All com. ply free edges should be provided with teakwood, steem beach lipping/ moulding all-round.
 - f. All joinery fittings and fixtures should be of approved make.
 - g. The **size** of the wooden frame to be provided as specified in the BOQ and drawings are **finished size** after doing necessary **surface wood planning** etc.
23. The Contractor should arrange for inspection of the sample of each item by the Architects/ Client proceeding with the work of manufacturing other units. The samples should be produced for inspection and approval of the Architects in the stages (1) after the same is assembled and made ready as per the Architect's drawings and (2) after completing the finishing items viz., polishing/ painting etc.
24. It may clearly be noted that the inspection and approval of the items of work at any stage shall not exonerate the Contractor of his responsibilities in respect of the quality of work, workmanship and quality of materials.
25. Rate should includes for providing necessary cutouts, holes for electrical conduits, switch boxes, plug points in work stations, partitions, tables, etc., wherever necessary and as shown in drawing along with the coordination of other agencies.
26. The rate also should include providing additional wooden members horizontal/ vertical adjacent to the switch box conduits etc., in order to support the switch box conduits etc.
27. The work should be completed as per the items specified elsewhere in the document and the rate quoted shall rate quoted shall include for doing work round the clock. No extra is payable in this respect.
28. The successful tenderer shall co-ordinate to other agencies engaged by the employer.

Signature of the Tenderer with seal:

Address:

Date:

ANNEXURE – I

Name of the Work: **Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai**

DECLARATION

I / We -----the bidder(s) for the present project do hereby solemnly declare that our Firm/ Company/ joint Venture/ Consortium is not under liquidation and the said entity is not under court receivership of any similar proceedings under court of any competent jurisdiction at the time of bidding.

Signature of the Tenderer with seal:

Date:

NOTE:

- 1) (In case of Partnership / Joint Venture) it should be signed by all partners.
- 2) In case of Consortium this declaration to signed by the leader.
- 3) Please strike out which is not applicable

LETTER OF SUBMISSION FROM CONTRACTORS

To

The Regional Director,
SBI Life Insurance Company Ltd Regional Office,
32/19-APEEJAAY Business center, Haddows Road,
Nungambakkam, Chennai – 6

Dear Sir/s,

SUB: Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai

.....

1. Having examined the site of work and Drawings, Specifications, General and Special Conditions of Contract, Schedule of Quantities relating to the Tender for proposed Interior work prepared by our Architects M/s. Pithavadian and Partners having obtained the Tender invited on behalf of the SBI Life.
2. I / We, the undersigned, hereby agreed to execute, complete, and maintain the proposed work in strict accordance with the Contract documents for the items described in the Tender at the item rates quoted by us in the Tender.
3. I / We undertake to complete and deliver the total work in **75 Days** from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later. If the work is not completed with stipulated time, we know that the penalty will be levied.
4. I / We enclose herewith interest free **Earnest Money Deposit for Rs.2,00,000/- (Rupees Two Lakhs Only)** by “Demand Draft” in the name of “**SBI Life Insurance Company Ltd Regional Office, Chennai**” and this sum shall be forfeited in the event of our failing to execute the Contract when called upon to do so by accepting our Tender in the event of this Tender being accepted, the above-mentioned **EMD** will be converted into part of the Security Deposit 2% of the accepted Tender value.
5. I / We are agreeable for a total Security Deposit 5 % of total contract value (Inclusive of EMD & ISD). 50 % of the security deposit shall be released after virtual completion of the works. Balance 50 % after successful completion of the Defect Liability Period We also know that no interest shall be payable to the amount retained by the SBI Life as security Deposit.
6. I / We agree to carry out the work as per approved plan specification terms & Conditions of the tender in the event of the Tender is being accepted.
7. We shall absolve the employer and Architects from any loss, damage, action etc. Rate quoted by us shall be inclusive of all such expenses.

8. I / We shall furnish the detailed Bar Chart/ PERT chart after receiving the work order indicating our schedule programme for the all the major activities of entire Interior works.
9. I / We shall strictly adhere to follow the labour laws in force from time to time by Central / state Government and other authority etc.

Name of the person having Power of Attorney to sign the Contract.

(Duplicate copy of Power of Attorney to Be submitted along with the Tender)

Yours faithfully,

Signature of Tenderer with seal

Date:

AGREEMENT TO BE SIGNED BETWEEN SBI LIFE AND CONTRACTOR

ARTICLES OF AGREEMENT made the day of2017 between

The Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6 in the district of Coimbatore (hereinafter called “the Employer”) which expression shall unless repugnant to the context mean & include its successors & assigns of the ONE PART and M/s.----- in the district of ----- (hereinafter called “the Contractor” which expression shall unless repugnant to the context mean & include) of the OTHER PART.

WHEREAS the Employer is desirous of “**Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai**” as per Schedule I of this Agreement and has caused drawings, bill of quantities, and a specification describing the work to be done as prepared by M/s. Pithavadian & Partners, Chennai. (hereinafter called “the Architects”).

AND WHEREAS the said drawings as per Schedule II including the bill of quantities and the specifications as per Architects’ specifications/ M.D.S.S. / Local PWD Specifications/ Highway Manuals/ The Indian Standard Specifications have been signed by or on behalf of the parties hereto:

AND WHEREAS the Contractor has agreed to execute upon and subject to the conditions set forth in Schedule III hereto attached (hereinafter referred to as “the Said Conditions”) the work shown upon the said drawings and described in the said specification and included in the said bill of quantities for the sum of Rs.------(Rupees -----).

NOW IT IS HEREBY AGREED AS FOLLOWS:

In consideration of the sum of Rs.-----/- (Rupees ----- only) to be paid at the times and in the manner set forth in the said conditions, the Contractor will upon and subject to the said conditions execute and complete the works shown upon the said drawings and described in the said specification and bill of quantities.

The Employer will pay to the Contractor the said sum of Rs.------(Rupees ----- only) or such other sum as shall become payable hereunder at the times and in the manner specified in the said conditions.

The term “The Architects” in the said conditions shall mean M/s. Pithavadian & Partners, Chennai, or in the event of their ceasing to be Architects for the purposes of this Contract, such other person 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. The Consultant so appointed subsequently shall be entitled to disregard or overrule any previous decision or approval or direction given or expressed by the Architects for the time being.

The said conditions, specifications, and priced bill of quantities shall be read and construed as forming part of this Agreement, and the parties hereto will 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 bill of quantities contained.

This Contract is neither a Fixed Lump Sum Contract nor a Piece Work Contract, but is a Contract to carry out work in respect of the entire work to be paid for according to actual measured quantities at the rates contained in the schedule of rates and probable quantities or as provided in the said conditions.

The Employer on his own through the Consultants/ Architects, reserves to himself the right of altering the drawings and nature of work or adding or omitting any items of work or having portions of the same carried out without prejudice to this Contract.

The Contractors represent that they have experienced and competent staff which will enable them to ensure proper quality check on materials, whether brought by the Contractors or supplied by the Employer to the Contractors, further the Contractors will carry out proper test as required by the specifications and will supervise the day-to-day working and execution of the Contract works.

(b) If the Consultant have any doubt about the quality of any materials or any difficulty in supervision of the day-to-day work, it shall be the duty of the Contractors to report the matter in writing forthwith to the Consultants and, for the time being, to suspend that portion of the work about which difficulty is experienced The Contractors will abide by the direction of the Consultants.

(c)The Contractors are aware though the Consultants will supervise the workday to day this will not absolve the Contractors to perform their obligations under Sub-Clause (a) & (b) above.

(d) The Contractors covenant and warrant that completed items of work as well as the entire work on completion will be in conformity with the specifications and the terms and conditions of this Contract and will be of quality and description as contained in Contract.

e) Time shall be considered as the essence of this Agreement and the Contractors hereby agree to complete the work within **75 Days** from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later. The said conditions subject, nevertheless, to the provisions of extension of time as contained in the said conditions.

This Agreement and Contract shall be deemed to have been made in Chennai and any questions or dispute arising out or in any way connected with this Agreement and Contract shall be deemed to have arisen, in Chennai and only the court in Chennai shall have jurisdiction to determine the same.

The selected Tenderer shall comply with all Rules regulations of statutory authorities and its Fire Department while carrying out the work of the internal additions/alterations in the SBI Life Premises, as per the plan prepared by Architects. In case any rules are deviated then such work shall be dismantled and reinstate the same at Contractors cost to the satisfaction of the Architect/ Client.

Contractors have to make all the arrangements for getting required permission/passes for the Labour connected with the project, prior to commencement of the work from the SBI Life Authority. "

All the debris lying at site shall be properly stocked and disposed off from time to time out of the municipal limit as per statutory rules in force.

Tarpaulin with scaffolding shall be erected while carrying out the Work to avoid nuisance to working staff, spoiling of SBI Life Property and any other Tenderers materials etc. wherever so required.

SCHEDULE – I

Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai

SCHEDULE – II

Drawing Nos. -----

SCHEDULE – III

1. Articles of Agreement
2. Content Sheet
3. Notice Inviting Tender
4. Instructions to Tenderers
5. Letter from Architects -----
6. Letter from Contractor -----
7. Letter Ref:-----
8. General Conditions of Contract.
9. Special Conditions of Contract.
10. Safety code.
11. Special Conditions.
12. Preamble.
13. Technical Specifications of Interior, works.
14. List of approved makes of Interior materials like Ply wood, Laminate, Paints, and Fittings etc.
15. Respective drawings.
16. Schedule of quantities.
17. Approved Programme PERT / BAR Charts – Separate.

As witness our hand the day and year first above written.

Signed by the Said Employer:
.....

In the Presence of Witnesses:

Name	:	.....	Name	:	.....
Occupation	:	.....	Occupation:		.....
Address	:	.....	Address	:	.....
	

Signed by the Said Contractor (s):
.....

In the Presence of Witnesses:

Name	:	.....	Name	:	.....
Occupation	:	.....	Occupation:		.....
Address	:	.....	Address	:	.....
	

INSTRUCTION TO THE TENDERERS

1.0 Scope of work

Sealed Tenders are invited by M/s. Pithavadian & Partners for and behalf of SBI Life for the work of **“Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai”**.

1.1 Site and its location

The proposed work is to be carried out for SBI Life Insurance Company Ltd Regional Office, No.6a, Centennial Sqare, 4th Floor, Dr.Ambedkar Road, Kodambakkam, Chennai

2.0 Tender documents

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

- Appendix A.
- Appendix B – Salient conditions of Contract.
- Instructions to Tenderers.
- General conditions of Contract
- Special conditions of Contract.
- Additional specifications.
- Drawings.
- Priced bid.

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) Additional Specifications.
- c) Technical specifications.
- d) Drawings.
- e) Special conditions of Contract.
- f) General conditions of Contract.
- g) Instructions to Tenderers.

2.3 Complete set of Tender documents including relative drawings can be obtained in person from the Architects M/s. Pithavadian and Partners, Chennai between 10-00 to 17.00 hours on any Day except holidays during the period mentioned in the NIT on payment of **Rs.3000/-** by

means of cash/ cheque/ demand draft drawn in favour of “**M/s. Pithavadian & Partners, Chennai**”, on any Scheduled SBI Life.

2.4 The Tender documents are not transferable.

3.0 Site Visit

3.1 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 satisfy himself regarding the availability of water, power, transport and communication facilities, the character, quality and quantity of the materials, labour, the law and order situation, 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 Tenderers are requested to submit the **Earnest Money Deposit for Earnest Money Deposit for Rs.2,00,000/- (Rupees Two Lakhs Only)**, in the form of Demand Draft in favour of “**SBI Life Insurance Company Ltd Regional Office, Chennai**” drawn on any Nationalized Bank in India.

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 Tenderers 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

The successful Tenderer will have to submit a sum equivalent to 2% of Contract value include EMD. By means of D/D drawn in favour of SBI Life Insurance Company Ltd Regional Office, Chennai

6.0 Security Deposit

6.1 5 % of total contract value (Inclusive of EMD & ISD). 50 % of the security deposit shall be released after virtual completion of the works. Balance 50 % after successful completion of the Defect Liability Period

6.2 No interest shall be paid to the amount retained by the SBI Life as Security Deposit.

7.0 Signing of Contract Documents -

The successful Tenderer shall be bound to implement the Contract by signing an Agreement and conditions of Contract attached herewith within 15 days from the receipt of intimation of acceptance of his Tender by the SBI Life. However, the written acceptance of the Tender by the SBI Life will constitute a binding Agreement between the SBI Life and successful Tenderer whether such formal Agreement is subsequently entered into or not.

8.0 Completion Period

Time is essence of the Contract and shall be strictly observed by the Contractor. The work should be completed in all respects in accordance with the Terms of Contract as below:-

(a) The time of completion of work is **75 Days from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later**

9.0 Validity of Tender

Tenders shall remain valid and open for acceptance for a period of **90 days** from the date of opening 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 SBI Life without prejudice to any other right or remedy the SBI Life shall be at liberty to forfeit the EMD.

10.0 Rate and prices:

10.1 In case of item rate Tender

10.1.1 The Tenderers shall quote their rates for individual items both in words and figures. In case of discrepancy between the rates 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 the total amount calculated from multiplication of unit rate and the quantity, the unit rate quoted will govern and the amount will be corrected.

10.1.2 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 Tenderer 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/ SBI Life before submission of Tender.

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

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

10.1.5 The rate quoted shall be firm and shall include all costs, allowances, taxes, levies.

GENERAL CONDITIONS OF CONTRACT

1.0 Definitions:

"Contract" means the documents forming the Tender and the acceptance thereof and the formal Agreement executed between SBI Life (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 / Client 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 Life' shall mean The Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6 and includes the Client's representatives, successors and assigns.

Architects/ Consultants' shall M/s. Pithavadian & Partners, Chennai.

1.1.2 'Site Engineer' shall mean an Engineer appointed by the Architect/ Client as their representative to give instructions to the Contractors.

1.1.3 'The Interior Contractor' shall mean the individual or firm or company whether incorporated or not, undertaking the Interior 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 firms of company.

The expression 'Interior works' or 'Interior work' shall mean Interior, Electrical Installation, and related works more fully described in BOQ and Drawings and the permanent or temporary work described in the "Scope of work" and / or to be executed and recorded in accordance with the Interior Contract and shall include all extra and or additional or altered or substituted items of works as required and required for the performance of the Contract and includes materials, apparatus, equipment, temporary supports, fittings and things of all kinds to be provided, the obligations of the Contractor hereunder and work to be done by the Interior Contractor under the Interior Contract.

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

1.1.5 a. 'Project Engineer' shall mean the representative of Contractor who will present at site and available at all times while the work is in progress for day to day supervising the works. He is a **Civil Engineer with interior, Electrical, HVAC work experience** and efficient Engineer in charge, who is approved by the Architect and must thoroughly understand all the trades entailed and be constantly in Attendance, while the person are at work. Any directions, explanations, instructions or notices given by the Architect to such Engineer shall be deemed to be given to the Contractor and shall be binding as such on the Contractor. The Project Engineer shall be thoroughly conversant with the English Language and should be able to read, write and-speak English.

1.1.6 '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 Interior 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.

1.1.7 '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 Architect Consultant "Month" means calendar month.

1.1.8 "Week" means seven consecutive days.

1.1.9 "Day" means a calendar day beginning and ending at OO Hrs and 24 Hrs respectively

CLAUSE

1.0. Language

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

2.0 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 the item in the specifications and descriptions in bills of quantities of the same item, the former shall be adopted.

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

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

3.0 Scope of work:

The Contractor shall carryout, complete and maintains the said work in every respect in strictly accordance with this Contract and with the directions of and to the satisfaction of the Client to be communicated through the Architect/ Consultant. The Architect/Consultant at the directions of the SBI Life from time to time issue further drawings and/ or written instructions, details directions and explanations which are hereafter collectively referred to as Architects/ Consultant's instructions in regard to the variation or modification of the design, quality or quantity of work or the addition or omission or substitution 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 substitution of any other materials therefore the removal and/ or re-execution of any work executed by him. The dismissal from the work of any person employed/ engaged thereupon.

4.0 i) Letter of Acceptance:

Within the validity period of the Tender the SBI Life shall issue a letter of acceptance either directly or through the Architect 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 LIFE and the Contractor.

ii) Contract Agreement:

On receipt of intimation of the acceptance of Tender from the SBI LIFE/ Architect the successful Tenderer shall be bound to implement the Contract and within fifteen days thereof he shall sign an Agreement in a non judicial stamp paper of appropriate value. (Rs.100/-)

5.0 Ownership of drawings:

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

6.0 Detailed drawings and instructions:

The SBI LIFE through its Architects/ 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 documents, true developments thereof and reasonably inferable there from.

The work shall be executed in conformity therewith and the Contractor prepare a detailed programme 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 LIFE through the Architect/ Consultant.

7.0 Copies of Agreement

Two copies of Agreement duly signed by both the parties with the drawings shall be handed over to the Contractors.

8.0 Liquidated damages:

If the Contractor fails to maintain the required progress in terms of respective clause GCC 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 LIFE on account of such breach to pay a liquidated damages at the rate of Rs.1,00,000/- per week subject to a maximum of 10 % of the total contract value The work is delayed beyond 3months the contractor will be terminated from the work.

9.0 Materials, Appliances, and Employees

Unless or otherwise specified the Contractor shall provide and pay for all materials, labour, 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 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 anyone not skilled in the work assigned to him. Workman whose work or behavior is found to be unsatisfactory by the SBI LIFE/ Architect/ Consultant, he shall be removed from the site immediately.

10.0 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 notices 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 LIFE 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 indemnify the SBI LIFE any legal actions arising there from.

11.0 Setting out Work:

The Contractor shall set out the work and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and get it approved by the Architect/ Consultant before proceeding with the work. If 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 LIFE.

12.0 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 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 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 bodies' safety laws and building codes to prevent accidents, or injuries to persons or property on about or adjacent to his place of work. The Contractor shall take insurance covers as per clause 24.0 at his own cost. The policy may be taken in joint names of the Contractor and the SBI LIFE and the original policy may be lodged with the SBI LIFE.

13.0 inspection of work:

The SBI LIFE/ 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 lying or from where they are obtained and the Contractor shall give every facility to the SBI LIFE, Architect/ Consultant and their representatives necessary for inspection and examination and test of the materials and workmanship. No person unless authorized by the SBI LIFE/ 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 organization a wing of Central Vigilance commission.

14.0 Assignment and subletting.

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

However in the Interior nature of works the Contractor after the approval of the SBI Life/ Architect/ Consultant, the work may be assigned to their associate agencies for the work like AC/ Electrical/ Fire Alarm within the conditions stipulated in the Tender elsewhere in the document.

15.0

(i) Quality of materials, workmanship & Test

All materials and workmanship shall be best of the respective kinds described in the Contract and in accordance with Architect/Consultant instructions and shall be subject from time to time to such tests as the Architect/Consultant may direct at the place of manufacture or fabrication or on the site or an approved testing laboratory. The Contractor shall provide such assistance, instruments, machinery, labour, 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 as 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 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 reasonable 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 in furnishing samples of best qualities from various manufacturers and such other aspects causing delay on the approval of the materials! / 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 specification or BOQ.

iv) Costs of tests not provided for

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

a) If so intended by or provided 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 or 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.

16.0 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 nor 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.

17.0 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.

18.0 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 19, 20 hereof as well as amounts 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 21 (e) hereof.

19.0 Works to be measured

The Architect/ Consultant may from time to time intimate to the Contractor that the required 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 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 M book should the Contractor 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.

20.0 Variations

No alteration, omission or variation ordered in writing by the Architect/ Consultant shall vitiate the Contract. In case the SBI LIFE/ 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, alterations, 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 may be.

21.0 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 LIFE 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 prices 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 as 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 rates stated in the Tender of the BOQ or, if not, so stated then in accordance with the local day work rates and wages 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 authorised extra items where rates cannot be derived from the Tender, the Contractor shall submit rates duly supported by rate analysis worked out on the "market rate basis" for material, labour, hire/ running charges of equipment and wastages etc. plus 15% towards establishment charges, Contractor's overheads and profit. Such items shall not be eligible for escalation.

22.0 Final measurement

The measurement and valuation in respect of the Contract shall be completed within 15 days of the virtual completion of the work.

23.0 Virtual completion certificate (VCC)

On successful completion of entire works covered by the Contract to the full satisfaction of the SBI LIFE, the Contractor shall ensure that the following works have been completed to the satisfaction of the SBI LIFE:

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

b) Demolish, dismantle and remove the Contractor's site office, temporary works, structures including labour sheds/camps and constructions and other items and things whatsoever

brought upon or erected at the site or any land allotted to the Contractor by the SBI LIFE and not incorporated in the permanent works.

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

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

e) Shall hand over the work in a peaceful manner to the SBI LIFE.

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

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 fifteen (15) 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 Contractor's liabilities under the Contract including the Contractor's liability for defects 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 LIFE against the Contractor in respect of works or work at the site and in respect of which the VCC has been issued.

24.0 Works by other Agencies

The SBI Life/ Architect/ Consultant reserves 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 Life. Such work shall be carried out in such manner as not to impede the progress of the works included in the Contract.

25.0 Insurance of works

25.1 without limiting his obligations and responsibilities under the Contract the Contractor shall insure in the joint names of the SBI LIFE and the Contractor against all loss of 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 LIFE and Contractor are covered for the period stipulated in the respective clause. of GCC 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 other things.

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

25.2 Damage to persons and property

The Contractor shall, except if and so far as the Contract provides otherwise indemnify the SBI LIFE 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 LIFE to execute the works or any part thereof on, 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 damage to persons or property resulting from any act or neglect of the SBI LIFE their agents, employees or other Contractors not being employed by the Contractor or for or in respect of any claims, 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 LIFE, their employees or agents or other Employees, or Agents or other Contractors for the damage or injury.

25.3 Contractor to indemnify SBI LIFE

The Contractor shall indemnify the SBI LIFE against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the provision sub-clause 24.2 of this clause.

25.4 Contractor's superintendence

The Contractor shall fully indemnify and keep indemnified the SBI LIFE 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 LIFE 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 LIFE 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.

25.5 Third Party Insurance

25.5.1 Before commencing the execution of the work the Contractor but without limiting his obligations and responsibilities under clause 24.0 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 LIFE, or to any person, including any employee of the SBI LIFE, 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 proviso to clause 24.0 thereof.

25.5.2 Minimum amount of Third Party Insurance

Such insurance shall be effected with an insurer and in terms approved by the SBI LIFE which approval shall not be reasonably withheld and for 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.

25.6 The minimum insurance cover for physical property, injury, and death is Rs.5 Lakhs per 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.

25.7 Accident or Injury to workman:

25.7.1 The SBI LIFE 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 workmen or other person in the employment of the Contractor or any sub-Contractor, save and except an accident or Injury resulting from any act or default of the SBI LIFE or their agents, or employees. The Contractor shall indemnify and keep indemnified SBI LIFE against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

25.7.2 Insurance against accidents etc. to workmen

The Contractor shall insure against such liability with an insurer approved by the SBI LIFE during the whole of the time that any persons are employed by him on the works and shall, when required, produce to the Architect/ Consultant such policy of insurance and receipt for payment of the current premium. Provided 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 LIFE 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.

25.7.3 Remedy on Contractor's failure to insure:

If the Contractor fails to effect and keep in force the insurance 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 LIFE 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 LIFE as aforesaid from any amount due or which may become due to the Contractor, or recover the same as debt from the Contractor.

25.7.4 without prejudice to the others rights of the SBI LIFE against Contractors. 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 LIFE and which are payable by the Contractors 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 goods destroyed or damaged.

26.0 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 LIFE which ever is later

27.0 Time for completion

Time is essence of the Contract and shall be strictly observed by the Contractor.

Time is essence of the Contract and shall be strictly observed by the Contractor.

The time of completion of work is **75 Days** from the date of commencement of work. Date of commencement is 15days from the date of issue of work order or the date of handing over the site, whichever is later

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.

28.0 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 LIFE to grant a fair and reasonable extension of time for completion of work as per the Terms of Contract. If the Contractor needs an extension of time for the completion of 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 LIFE 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 LIFE in the prescribed format for granting extension of time. While granting extension of time the Contractor shall be informed the period extended time which will qualify for levy of liquidated damages. For the balance period in excess of original stipulated period and duly sanctioned extension of time by the SBI LIFE the provision of liquidated damages as stated under Clause 8.0 of GCC shall become applicable. Further the Contract shall remain in force even for the period beyond the due date of completion irrespective whether the extension is granted or not.

29.0 Rate of progress

Whole of the materials, plant and labour to be provided by the Contractor and the mode, manner and speed of execution and maintenance of the works are 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 he will be entitled to raise any claims arising out of such directions.

30.0 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 works being technically required/ continued with the prior approval of the Architect/ Consultant at no extra cost to the SBI LIFE.

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

31.0 No compensation or restrictions of work

If at any time after acceptance of the Tender SBI LIFE shall decide 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 Contractor and the Contractor shall act accordingly in the matter. The Contractor 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 consequence of the foreclosure of the whole or part of the work.

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

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

32.0 Suspension of work

i) The Contractor 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 works or any part thereof for such time and in such manner as 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 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 default of the Contractor, or

c) For safety of the works or part thereof:

The Contractor 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.

d) If the suspension is ordered for reasons (b) and (c) in sub-Para (i) above:

The Contractor 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.

33.0 Action when the whole security deposit is forfeited

In any case in which under any clause or clauses of this Contract, the Contractor 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 LIFE.

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

b) To employ labour paid by the SBI LIFE and to supply materials to carry out the work, or any part of the work, debiting the Contractor with the cost of the labour and materials (the cost of such labour 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 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 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 Architects / Consultant shall be final and conclusive) shall be borne by original Contractor and may be deducted from any money due to him by SBI LIFE 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 LIFE the Contractor shall have no claim to 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 be 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.

34.0 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 LIFE 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 15 days after receiving from the SBI LIFE 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 with in 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 LIFE 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 of the SBI's or Architect's / Consultant's instructions to the contrary subject any part of the Contract. Then and in any of said cases the SBI LIFE 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 powers of the SBI LIFE 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 LIFE 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 way 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 or as soon thereafter as convenient the SBI LIFE 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 LIFE sell the same by public auction after due publication, and shall adjust the amount realized by such auction. The Contractor shall have no right to question any of the acts of the SBI Life incidental to the sale of the materials etc.

35.0 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 issuing Certificate for payment from SBI LIFE from time to time. The SBI LIFE shall recover the statutory recoveries other dues including the retention amount from the certificate of payment.

Provided 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 relieve 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 LIFE shall modify the certificate of payment 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 1/5 of total Contract value and the minimum interval between two such bills shall be 15 days.

The final bill may be submitted by Contractor within a period of 15 days from the date of virtual completion and Architect/ Consultant shall issue the certificate of payment within a period of 15 days. The SBI LIFE shall pay the amount within a period of one month from the date of issue of certificate provided there is no dispute in respect of rates and quantities.

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

36.0 Settlement of disputes and arbitration

36.1 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, instructions 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.

36.2 If the Contractor considers 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 Regional Director, SBI Life Insurance Company Ltd Regional Office, 32/19-APEEJAAY Business center, Haddows Road, Nungambakkam, Chennai - 6 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 give 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 SBI Life 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.

36.3 The Regional Director gives 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 Regional Director submit his claims to the conciliating authority namely the The Director SBI Life Insurance Company Ltd, Mumbai for conciliation along with all details and copies of correspondence exchanged between him and the The Regional Director SBI Life Insurance Company Ltd, Chennai

36.4 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 The Director of the SBI Life for appointment of an arbitrator to adjudicate the notified claims falling which the claims of the Contractor shall be deemed to have been considered absolutely barred and waived.

36.5 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 SBI Life shall be referred for adjudication through arbitration by the Sole Arbitrator appointed by the Director. It will also be no objection to any such appointment that the Arbitrator so appointed is a SBI Life Officer and that he had to deal with the matters to which the Contract relates in the course of his duties as SBI Life Officer. If the arbitrator so appointed is unable or unwilling to a 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 Director. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

36.6 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.

36.7 It is also a term of this Contract that no person other than a person appointed by such Director as aforesaid should act as Arbitrator.

36.8 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 the rules made there under.

36.9 It is also a term of the 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 SBI Life Officer.

36.10 It is also a Term of the 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 the 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.

36.11 Work to be continued during the pendency of the arbitration

The Contractor shall continue with the construction work with due diligence and speed so as to complete the same within the period agreed upon, notwithstanding any dispute or different or question as referred to arbitration The works shall not be delayed on account of any such reference made to the Arbitrators

37.0 Water supply

The contractor shall make his own arrangements for water required for the work and nothing extra will be paid for the same.

38.0 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 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 SBI Life free from all such costs. He has to obtain necessary approval from the appropriate authorities, if required.

39.0 Treasure trove etc.

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

40.0 Method of measurement

Unless otherwise mentioned in the schedule of quantities or in mode of measurement, the measurement will be on the net quantities or work produced in accordance with up to date. Rules laid down by the Bureau of Indian Standards prevailing at the time of Tendering. In the event any dispute / dis-Agreement the decision of the Architect / Consultant shall be final and binding on the Contractor.

41.0 Maintenance of Registers

The Contractor shall maintain the following registers as per the enclosed proforma at site of work and should produce the same for inspection of SBI LIFE / Architect / Consultant whenever desired by them. The Contractor shall also maintain the records / registers as required/by any of the Local Authorities/ Govt./ Statutory Bodies form time to time.

1. Registers at the site office of the SBI Life's Engineer.
2. Drawings register.
3. Materials at site register.
4. Hindrance Register.
5. File and Register for extra / variation items.
6. Materials tests Register and File.
7. Site Order Book (in triplicate).
8. Labour Reports and progress Reports register.
9. Site visit & Instructions Register.
10. Certified true copies of the Contracts.

42.0 The successful Tenderers may also note that the SBI Life reserves the right to deduct Sales Tax on works Contract applicable and to be levied under relevant Act, from the bills and amount due to them from SBI Life and remit the same directly to the Government in case they are not submitting the proof/evidence of having paid the Sales Tax on work executed under this Contract. Sales Tax shall be deducted as per Latest Govt. norms.

43.0 Force majeure

43.1 Neither Contractor nor SBI LIFE 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, civil commotion, strikes, lockout, conflagrations, epidemics, accidents, fire, storms, 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.

43.2 As soon as the cause 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.

43.3 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 itself and inability resulting therefrom 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.

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

44.0 Local laws, Acts, Regulations:

The Contractor shall strictly adhere to all prevailing labour laws inclusive of Contract labour (regulation and abolition act of 1970) and other safety regulations. The Contractor shall comply with the provision of all labour legislation including the latest requirements of all the Acts (latest), laws (latest), 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 labour 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 thereunder from time to time.

45.0 Accidents

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

46.0 Contractors Superintendence and Representative on works

The Contractor shall give all necessary personal superintendence during the execution of the works and as long thereafter as the Architect / Client and consider it necessary until the expiration of the "Defects Liability Period" stated in respective Clause. The Contractor shall meet the Consultant or his representative whenever required if demanded by Architect / Client.

The Contractor shall maintain and be represented on site, at all times while the work is in progress, by a responsible and efficient "Project Engineer" who is in charge of site, approved by the Architect and who must thoroughly understand all the trades entailed and be constantly in Attendance, while the person are at work. Any directions, explanations,

instructions or notices given by the Architect / Client to such Project Engineer shall be deemed to be given to the Contractor and

Shall be binding as such on the Contractor. The Project Engineer shall be thoroughly conversant with the English Language and should be able to read, write and-speak English.

47.0 Role of the Architect/ Consultant

Architect/Consultants duty is to be watch and supervise the works on day to day basis and to test any materials to be used or workmanship employed in connection with the works, quality control, project scheduling and monitoring and co-ordination with all other agencies and Interior Contractor, recording of measurement clarifications of bills, preparing extra deviation items excess / saving statement preparing minutes of meetings etc. They shall have no authority either to relieve the Contractor of any of his duties or obligations under the Contract or, except those expressly provided hereunder, to order any work involving delay or any extra payment by the Employer or any variation of or in the works.

The Contractor shall afford the Architect/Consultant every facility and assistance for examining the works and materials and checking and measuring time and materials. The Architect/Consultant shall have no power to revoke, alter, enlarge, or relax any requirements of this Contract, or to sanction any day-work, additions, alterations, deviations or emissions unless such in authority may be specially conferred by a written order of the Employer.

The Architect/Consultant shall act in consultation the Structural Consultant in regard to the quality of all Structural aspects of the work and in consultation with the Architect will finalize the selection of materials involved. The Consultant shall jointly record the measurements with Contractor's representative for all items of works and on completion hand over the records to the Employer.

The Architect / Consultant shall have the power to give notice to the Contractor or his Engineer in charge about the non-approval of any work or materials and such works shall be suspended or the use of such materials should be discontinued until the decision of the Architect / Employer is obtained, the work, will from time to time visited by the Architect / Employer but such examination shall not in any way exonerate the Contractor from the obligation to remedy any defects which may be found to exist at any stage of the work or after the same is completed. Subject to the limitations of this Clause, the Contractor shall take instructions only from the Architect as the case may be.

The Architect / Consultant shall have such other powers and discharge other functions as are specifically provided in this Contract including such incidental or consequential powers or duties, subject always to such specific instructions or directions of the Employer / SBI Life, which shall be duly notified to the Contractor.

48.0 Architects delay in progress

The Architect / Consultant may delay the progress of the work in case of rain or otherwise, without vitiating the Contract and grant such extension of time with the Approval of the Employer / SBI Life for the completion of the Contract as he may think proper and sufficient in consequence of such delay and the Contractor shall not make any claim for compensation or damage in relation thereto.

49.0 Photographs of works carried out

The Contractor shall every month supply at his own cost a reasonable number of Maxi size colored photographs of the works carried out from time to time as per the instructions of, the Architect / Consultant. In the event of any dispute or termination of Contract either by the Employer / SBI Life or the Contractor as provided for in the respective Clause, the Contractor shall arrange to obtain Photographs of the works completed up to the date of such termination of Contract.

50.0 Technical Audit Clause

The work is liable to be technically audited by the chief Technical Examiner of the Central Vigilance Commission of the Government of India from time to time. Any defects, improvements or testing etc. pointed out by the Chief Technical Examiner should be carried out by the Contractor at his own cost and any deduction suggested by the CTE will be effected.

The Employer shall have a right to cause a technical examination and audit of works and the final bills of the Contractor including all supporting vouchers, abstract, etc. to be made at the time of payment of the final bill. If as a result of this examination or otherwise any sum is found to have been overpaid in respect of any work done by the Contractor under the Contract the Contractor shall be liable to return the amount of over payment and it will be lawful for the employer to recover the same from any sum or due to him and in any other manner legally permissible and if it is found, that the Contractor was paid less than what was due to him under the Contract in respect of any work, executed by him under the Contract the amount of such under payment shall be duly paid by the Employer.

Any sum of money due and payable to the Contractor (including Security deposit returnable to him) under this Contract may be appropriated by the Employer and set off against any claim of the Employer for the payment of a sum of money arising out of or under any other Contract made by the Contractor with the Employer.

51.0 Procedure for Billing

Contractor shall submit three copies of their bill on white paper for Tender items.

As regards Contractor's claims for extra /deviated items the onus of getting Architect's / Consultant's / Owner's approval for the admissibility of such items lies on the Contractor.

After the admissibility is confirmed by Client in writing, the Contractor will submit his rate analysis and details of claims.

The Contractor will include extra/deviated items in his interim bills only after Employers approval of rates on the basis of Consultant recommendations.

52.0.Deletion of items from Bills of Quantities

The Employer reserves the right to delete any item from the bill of quantities drawn up. The Contractor will not have any claim on this account whatsoever.

53.0. Reinstatement of Items

In case of items like making good the new plaster of Paris work in false ceiling after the alteration, and matching the finish with the existing one, the finish will have to be done perfectly. In this case Architects / Consultant's decision will be final regarding the acceptability

of finish. If the reinstatement is not accepted by the Architect / Consultant, the same will have to be done again to Architect / Consultant's and Client's satisfaction at no extra cost.

54.0 Wages of labour Employed by the Contractor

The Contractor shall pay all labour employed by him at rates fixed by him at the commencement of the Contract as per the Labour Laws. Wages as applicable for the Construction work as per norms stipulated by the Government statutory authorities shall be followed by the Contractor. No variation of such statutory. Laws & rules shall be permissible. This will also include the minimum & the maximum allowable wages for various categories of Labour to be employed by the Contractor.

All wages shall be paid in full and without any deductions whatsoever at the approved rates and for the full time actually worked during the wage period. The Engineer or such other officer of the Employer maybe authorized in that behalf and shall have power to exercise supervision over the labour employed by the Contractor and or such purpose any of these officers may inspect the wage books, muster books and other labour records of the Contractor, In the event of the report of the inspecting officer showing that the proper rates of wages are not being paid, or that in any manner whatsoever the dealings between the Contractor and his labour are not satisfactory the Engineer shall pass such orders upon the report as he considers desirable, and those orders shall be final and binding upon the Contractor. The Contractor shall indemnify & keep indemnified the Architect / Consultant against any claim arising from failure of the Contractor to comply with such labour laws.

55.0. Approval of Mock-Up and Samples

It will be the Contractor's responsibility to obtain written approval of mock-ups and samples from the Architect/ Consultant and Employer. If this is not done, such items where these materials are used will be rejected by the Architect / Consultant / Employer.

56.0 Approval of Final Finish in case of Polishing and Painting

In case of items for painting and polishing, normally primer and three coats should suffice However, to achieve the final finish, to Employer's / Architect's / Consultant's satisfaction, it may become necessary to-have more than three coats. This will have to be done by the Contractor at no extra cost.

57.0 Non-Availability of Specified Materials / Items

In case of materials / Items which are not available, the Contractor shall have to submit a letter from manufacturer to that effect. After proper verification, alternative material may be selected by the Employer/Architect / Consultant. In the case there will not be any increase of the quoted rates. However, if Accepted alternative is cheaper the cost benefit is to be passed on to the Employer.

58.0 Address for Service

All letters and Notices under or pursuant to these presents shall be hand delivered against acknowledgement or sent by Registered Post with Acknowledgement due at the respective addresses mentioned below. Any change in the addresses shall be duly intimated by the concerned Party to all others.

I. Address for Employer

The Regional Director,
SBI Life Insurance Company Ltd Regional Office,
32/19-APEEJAAY Business center, Haddows Road,
Nungambakkam, Chennai – 6

2. Address for Architects

M/s. Pithavadian & Partners,
10, Murugappa Road,
Kotturpuram, Chennai - 600 085

3. Address for the Contractors

M/s. -----

SIGNATURE OF THE TENDERER WITH SEAL

SPECIAL CONDITIONS OF CONTRACT.

Scope of work

1.0 The scope of work is to carry out the work of “**Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai**”.

2.0 Address of site

The proposed work is to be carried out for SBI Life Insurance Company Ltd Regional Office, No.6a, Centennial Square, 4th Floor, Dr.Ambedkar Road, Kodambakkam, Chennai

3.0 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.

4.0 Notice of operation

The Contractor shall not carryout any important operation without the Consent in writing from the Architect/ Consultant.

5.0 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.

6.0 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.

7.0 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 drawings 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.

8.0 Water, power and other facilities

- a) The SBI LIFE as well as the Architect/ Consultant shall give all possible assistance to the Contractors to obtain the requisite.

- b) Permission from the various Authorities, but the responsibility for obtaining the same in time shall be of the Contractor.

9.0 Office accommodation

- a) The Contractor shall provide and maintain a necessary offices, workshops, stores, shelters, sanitary facilities, canteens and other temporary structures for themselves in connection 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 LIFE/ Architect/ Consultant shall be provided by the Contractor at his own expenses.
- c) All temporary buildings and facilities as mentioned above shall be removed on completion of the work of at any other earlier date as directed by the Architect/ Consultant.
- d) All the expenses for obtaining statutory approvals and maintenance of the above facilities as well as running expense 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.

10.0 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 arrangements at his own cost for transport where necessary for his staff and workmen to and from site of work at his own cost

11.0 Lighting of works

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

12.0 Site order book

A site order book shall be maintained at site for the purpose of quick communication between the Architect/ Consultant. Any communication relating to the works may be conveyed through 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 triplicate and shall carefully maintained and preserved by the Contractor and shall be made available to the Architect/ Consultant as and when demanded. Any instruction which the Architect/ Consultant may like to issue to the Contractor or the Contractor 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 acknowledgment and the second copy will be retained for their record.

13.0 Temporary fencing/ Barricading

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

16.0 Contractor to verify site measurement

The Contractor shall check and verify all site measurements whenever requested by other specialists 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 therein 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 get 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/ 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.
- iii. The Contractor will modify the drawing prepared by him wherever the changes are made by the SBI LIFE/ 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, aluminium doors and windows and any other item 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 arrangements 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 sales tax, tax on works Contract excise duty, and octroi, payable in respect of materials, equipment plant and other things required for the contract. All of the aforesaid taxes, duties, levies, fees and charges shall be to the Contractor's account and the SBI LIFE shall not be required to pay any additional or extra amount on this account. Variation of taxes, duties, fees, levies etc if any, till completion of work shall be deemed to be included in the quoted rates and no extra amount on this account. Variation of taxes, duties, fees, 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 statute or law during the currency of Contract the same shall be borne by the Contractor.

23.0 Acceptance of Tender

The SBI LIFE shall have the right to reject any or all Tenders with out assigning any reason. They are not to bound to accept the lowest or any Tender and the Tenderer or Tenderers shall have no right to question the acts of the SBI LIFE. However adequate transparency would be maintained by the SBI LIFE.

24.0 The prices shall be Firm for the duration of Contract plus all authorized extensions of time plus three months period after completion of work. All rates will be including turnover tax, sales tax, works Contract tax and all other taxes etc.

25.0 The Contractor is to furnish the 2 basic of various materials likely to be used in the interior work so as to serve as guidelines for working out the rates analysis for extra/ taxes, duties etc

26.0 The Contractor is to quote for all sections of the Bills of Quantities.

29.0 CLIENT / ARCHITECT / CONSULTANT reserve the right to ask the Contractor to prepare 'Mock-up' of any item for their approval before proceeding with the work.

SAFETY CODE

1. First aid appliances including adequate supply of sterilized dressing and cotton wool shall be kept in a readily accessible place.
2. An injured person shall be taken to a public hospital without loss of time, in cases where the injury necessitates hospitalization.
3. Suitable and strong scaffolds should be provided for workmen for all works that cannot safely be done from the ground.
4. 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.
5. The excavated material shall not be placed within 1.5 meters of the edge of the trench or half of the depth of trench whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.
6. Every opening in the floor of a building or in a working platform is provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one metre.
7. No floor, roof or other part of the structure shall be so overloaded with debris or materials as to render it unsafe.
8. 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.
9. Those engaged in welding works shall be provided with welder's protective eye shields and gloves.

10.
 - i. No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
 - ii. Suitable facemasks should be supplied for use by the workers when the paint is applied in the form of spray or surface having lead paint dry rubbed and scrapped.
11. 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.
12. Hoisting machines and tackle used in the works, including their attachments, anchorage and supports shall be in perfect condition.
13. 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 OF SITE ORDER BOOK

1. Name of the work _____

2. Date of Commencement _____

Sr. No.	Remarks / Instructions of the Site Engineer / Architects	Dated Initials of Site Engineer / Architects	Initials of the Contractor for having received the instructions	Action taken with date	Dated Initials of the Site Engineer	Remarks of the Architects PMC / CC Officials.
1	2	3	4	5	6	7

PROFORMA FOR APPLICATION BY CONTRACTOR FOR EXTENSION OF TIME

1	Name of work	
2	Name of Contractor	
3	Contract Cost	
4	Date & Reference of work order	
5	Date of start of work (As per work order)	
6	Time period as per tender	
7	Scheduled Date of completion	
8	A. Interim schedule if any	
9	Reasons for delay and period of Delay for each reason including Corrective action taken by SBI Life / Architect (quote & attach references Wherever necessary)	
10	Responsibility for each reason for delay (a) SBI Life (b) Architect (c) Contractor (d) unforeseen circumstance (e) force measures etc. and corrective action not been taken (Attach references of letters etc.)	
11	Present status of work	
12	Any interim schedule / milestone achieved	
13	Any other hold/restraint envisaged in the completion of the remaining work. suggest corrective actions necessary	
14	Recommendation for the no of days of extension along with reasons	
15	Financial loss to the SBI Life if any due to this extension and recommendations for liquidated damages if justifiable (State reasons)	

Signature of Contractor

PROFORMA 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 / PE	SE	Remarks
1	2	3	4	5	6		7

SE = Site Engineer

PE = Project Engineer

Name of Work: Proposed Interior, Electrical, HVAC, Fire Alarm, Sprinkler System Works for SBI Life Insurance Company Ltd Regional Office, Chennai

I. List of Materials for Interior Works

S.No.	Names of materials	Approved Makes
1.	Commercial Ply (MR Grade) IS 303 : 1989	Mayur ply, Green Ply, Archid Ply, Century Ply, Anchor ply, Sharon ply,
2.	BWR Grade ply IS 303 : 1989	Mayur ply, Green Ply, Archid Ply, Century Ply Anchor ply, Sharon Ply
3.	Veneer IS: 1328 : 1996	Green, Century, Mayur, Archid, Anchor
4.	Laminate IS 2046 - 1995	Green, Century, Royal Touch, Formica, AICA, Archid, VIR, Bloom, Anchor
5.	Flush Door (MR Grade) IS 2202 (Part 1):1990	Anchor, Green, Mayur, Century, Archid
6.	Gypsum False Ceiling	India Gypsum, USG, Armstrong, Lafarge
7.	Mineral Fibre Board	Armstrong, Saint-Gobain, USG, Insula
8.	Acoustic Wall panelling	Armstrong, Saint Gobain
9.	Metal Door	Sakthi, International, NCL
10.	Fire Rated partition	Saint Gobain, Ramco-Hilux.
11.	Acrylic Surface Top	Corian, Asian, Stratton, Dupont
12.	Aluminium Composite panel (ACP)	Almaster, Aludécor, Alstrong, URO
13.	Bamboo blinds	Vistalevor, Rossate, Vyoma, NL
14.	Roller Blinds	Vistalevor, Aerolux, MAC, NL
15.	Door Closers, Floor Spring	Dorma, Union, Ingersoll rand
16.	Locks	Godrej, Dorma, Dorset, Ozone
17.	Furniture fittings and fixtures, Telescopic Slides	Sleek, Hettich, Haffle, Ozone, EZ
18.	Hardware	Efficient, Ebbco, Dorma, Ozone
19.	Screws	GK, Patpa
20.	Clear Glass / Tinted Glass	Indo-Ashahi, Saint-Gobain, Modi-Guard
21.	Adhesive	Speedy Fevical, Vamical,
22.	Plastic Emulsion, Oil bound Distemper, Synthetic enamel paint	Asian, Berger, ICI, Nerolac
23.	Melamine	Asian, Sheenlac, MRF
24.	MDF Board – Exterior Grade	Mayur, Green, Sharon, Archid, Anchor, Swastik, Century

I. List of Materials for Electrical and Light Fixtures:

Sr No	Description	Makes
1.	FRLS copper wire	Finolex, RR Kabel, Orbit, polycab
2.	Modular switches and sockets	MK, Salzzer, Anchor Roma
3.	MCBs and DBs	Legrand, Siemens, GE, HPL, Schnider
4.	UG cables (1.1Kv)	Polycab, Kei, Universal, Finolex,
5.	Tel cable	RR Kabel, Anchor, Delton, Finolex
6.	MCCB	L&T, Schenider, Siemens, Legrand
7.	PVC conduits (ISI)	AvonPlast, Sun, BajajPlast, Precision
8.	MS conduits (ISI)	BEC, Vimco , Sun Gupta
9.	Krone block housing	Henzel
10.	Capacitors	Epcos, Electronica, Baluk, L&T
11.	Timers	Schenider, L&T, Legrand
12.	Contactors	GE, Siemens, Schenider, L&T
13.	APFC relay	Epcos, Baluk, ICD
14.	APFC panel	Wave form, ICD, Unitech
15.	Change over switch	HPL, Standard, CS
16.	Multi function meter	ICD, Socomec, Conserve
17.	Exhaust fan& ceiling fan	Crompton, Bajaj, Usha
18.	Light fittings	Wipro, Crompton, K-lite, Thorn
19.	LED Fittings	Philips, GE, Crompton Greaves

CONDITIONS OF CONTRACT

1. The work should be carried out as per IER 1956 amended up-to-date and to the entire satisfaction of Client/Architect/Electrical Consultant
2. Colour coding should be strictly followed for the entire installation as per standards. Circuit wires and point wires should have distinct colour coding
3. All the MCB used in the works should be rated for 10 KA and with 'C' curve
4. The distribution board, A/c control box, switch control boxes etc., shall have the enclosures as supplied by the manufacturer
5. Circuit wiring shall be measured from the distribution board up to first switch control box only. Looping circuit shall not be paid for separately
6. All circuits shall be run in individual conduits only. Circuits of the same phases if required may be run in the same conduit with the consent of the Electrical Consultant. However the rates for the same shall be revised accordingly
7. Junction/Adopter boxes shall be provided wherever necessary for termination of conduit/cable as required without any additional cost. Junction boxes are permitted only above MDB/PDB/LDB. Junction boxes if required in other places, shall be fixed only with the consent of the Architect
8. The rates quoted shall be inclusive of all Civil works for embedding the conduit (in ceiling/wall/floor), recessing switch control box, distribution boards etc., with rough plastering. Chicken mesh should be used while plastering when number of conduits exceeds two in a row
9. The rates quoted shall be inclusive of all Taxes and Duties currently as applicable
10. The quoted rates shall be self sustaining and shall remain valid for any increase or decrease in quantity
11. The rates quoted shall remain firm till the entire installation is handed over. No revision of rates shall be entertained at any cause
12. All equipment used in the work shall be new and of best quality confirming to IS and ISI stamped unless otherwise approved
13. Additional work if any required by the client shall be carried out with the consent of the Client/Architect/Electrical Consultant
14. Necessary shop drawing shall be submitted for all the panel boards for the approval of the Client/Architect/Electrical Consultant
15. The underground cable laid in g round should be buried to a depth of 750 mm below ground level and shall be protected with well burnt bricks both on sides and on top over a sand cushion of 150 mm fine river sand. (75 mm below and 75 mm above the cable. The rate should also include for making good the surface as required. Suitable Cable route indicators should be provided at intervals of 25 mts. as per site

requirement without any additional cost. HT cable should be buried to a depth of 1000 mm below ground level

16. The earth electrode should be provided only in the presence of Electrical Consultant/Client's Engineer
17. The contractor should test all the cables for insulation and the earth electrode for resistance and submit the results to the Electrical Consultant/Client
18. The contractors shall submit the bill in quadruplicate for certifying for payment
19. The contractor should submit 4 copies of 'As fitted drawings' for the entire installation showing the conduit layout, location of panels, DBs, switch control boxes etc., along with the Final bill. Final bill will not be entertained without the 'As fitted drawings'

20. **It is the responsibility of the contractor to liaise with the local Electricity Board, get the feasibility report, additional load sanction and obtain the connection for the premises as required. However the client shall arrange to pay necessary deposit and service connection charges etc., to the Electricity Board**

21. Contractor should appoint a Site Electrical Engineer with suitable 'C' licence for day to day supervision of the Electrical works and allied works. The electrical works should be carried out by qualified Electricians (skilled / semi skilled) with relevant experience etc.

22. Taxes as per statutory requirement shall be deducted from the contractor's bill before making final payment

23. Retention money as stipulated in the tender will be with held from the contractors bill and the same shall be released after completion of Defects Liability Period

24. As the work has to be carried out in the Building, utmost care should be taken by the contractor not to disturb the structure of the Building. All debris should be removed from site of work on day to day basis and the premises should be kept clean. Identification of all panels and entire Electrical installation as per SLD/Specification.

25. All the panels should be tested for High Voltage and insulation as per standard norms without any additional cost in the presence of Clients Engineer/Electrical Consultant

26. The test results for the panels should be submitted in triplicate

27. The minimum and maximum operating height for all the panels should be maintained at 450mm & 1800 mm respectively from the finished floor level or as directed Engineer incharge / Architect / Electrical Consultant.

28. Copper bus bars should be provided for the entire length of the bus bar chamber and suitable ventilation louver should be provided in the bus bar chamber. Meter/Fuse switch unit should not be fixed in the bus bar chamber

29. All the feeders in the panel board should be suitably identified with reverse engraving plates with details of feeder, cable size etc.

30. Removable type gland plate should be provided in the cable chamber and suitable gland holes should be provided in the panel (including for spare/dummies) before powder coating
31. Door of the cable chamber should be provided with push type spring loaded knobs and should be made in two sections if the length exceeds more than 1200 mm
32. The panel should be provided with ring main earthing using 25 x 3 mm copper flat and all the feeders in the panel should be provided with two distinct earth connections. The earth flat run inside the bus chamber should be suitably shrouded and the earth flat distinctly colour coded.
33. The Contractor shall responsible to complete the Entire Electrical installation and allied works as per specification and relevant IS standards if not mentioned in the tender.
34. The Client/Architect reserves the right to accept/reject any or all tenders either in full or in part without assigning any reason

Signature of the Contractor

I - TECHNICAL SPECIFICATION FOR INTERIOR WORK

1. General

These specifications are for work to be done, items to be supplied, materials, to be used in the work shown and defined on the drawing and described herein, to the satisfaction of the Employer / SBI Life / Architect

1.1 The workmanship is to be the best possible and of a high standard. The Contractor shall take all steps immediately to make deficiencies if any noticed by the SBI Life / Architect. Use must be made of special tradesman in all aspects of the work and allowances must be made in the rates for the same.

1.2 The materials to be provided by the contractor shall be accordance with the samples already got approved from the SBI Life / Architect by the contractor and in conformity with specification and approved; list of manufactures and brand The contractor shall produce all invoices, vouchers or receipts for any materials if called upon to do so by The SBI Life / Architect.

1.3 Samples of all materials are to be submitted to the SBI Life/Architect for the approval before the contractor orders or deliver the materials to the site. Samples together with their packing are to be provided free of charge by. The contractor and should any materials to be rejected, they will be removed from the site at the contractor's expenses. All samples will be retained by the SBI Life / Architect for comparison with materials which will be delivered at site. Also the contractor will be required to submit the specimen finishes of colours, fabrics etc., for the approval of the SBI Life / Architect before proceeding with the work.

1.4 The contractor shall be responsible for providing and maintaining temporary coverage required for the protection of finished work. He is also to clean out all wood· shaving, cut ends and other waste from all parts of the work before covering or in filling is constructed.

1.5 Contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.

1.6 Site order Books / reports for the purpose of quick communication between the Architect / Architect's representative and the contractor or his agent or representative, site instruction books shall be maintained at site in the manner as described below.

1.6 Any communication, relating to the works may be conveyed through records in the site instruction book. Such communication from the Architect / Architect's representative to the contractor shall be deemed to have been adequately served in terms of the contract. Each site instruction book shall have machine number pages in triplicate and shall be carefully maintained and preserved by the contractor at site. Any instruction or others which the Architect / his representative may like to issue to the contractor may be recorded by him in the site instruction book and one copy thereof issued to the contractor.

1.7 The contractor shall check and verify all site levels and measurements whenever requested by the other specified contractors to enable them to prepare their own shop drawings and pass on the information with sufficient promptness. A copy of all such information passed on shall be given to the consultants.

1.8 Templates, boxes and moulds shall be accurately set out rigidly constructed so as to remain accurate during the time they are in use.

1.9 All unexposed surface of timber eg: - partition/paneling frames, false ceiling, backing, fillets, backs of door frames, cupboards framing, grounds etc are to be treated with two coats of approved timber preservative and anti termite paints before fixing or converging.

2. Joinery in woodwork

2.1 The contact surface between internal frame and skinning shall be glued with approved adhesive in addition to fixing with necessary screws etc.

2.2 After preparing proper surface of skinning by sand preparing etc., the laminate or veneers shall be fixed on it with the help of approved adhesive.

2.3 Frame work for full height partition shall be rigidly fixed to the floor, walls and ceiling soffit. The partition height shall be measured up to bottom of false ceiling and framing members / ply going above will not be measured.

2.4 Any portion that are warped or found with other defects are to be replac^od. The whole of the work is to be framed and finished in a workman- like manner in accordance with detailed drawings and the direction of SBI Life / Architect and whenever required, fitted with all necessary metals ties, straps, screws, adhesive etc. Joinery work generally to be finished with fine sand/glass paper.

2.5 All joins shall be standard mortise and tongue & groove, dowel, or cross-halved. Screws, nails, etc. will be of standard iron or wire. Tenon should fit the mortises exactly.

2.6 Nailed or glued butt joints will not be permitted.

2.7 Whenever screw heads are on finished surfaces those will be sunk and the hole plugged with a wood plug of the same wood and grain to match the colour.

2.8 The contact surfaces of dowels, tenons, wedges etc., shall be glued with approved adhesives. Were glued, joinery and carpentry works is likely to come into contact with moisture, the glue should be water proof.

3. Timber

3.1 All the Sal wood, Steam, Beach wood, CP teak, BTC to be used shall be properly seasoned, of natural growth and shall be free from worm holes, loose or dead knots or other defects, sawn square and shall not suffer from warping, spitting or other defects.

3.2 The moisture content shall not exceed 12%

3.3 All internal frameworks shall be treated with approved wood preservative, anti termite and with fire retardant treatment/paint.

3.4 All wood brought to site to be clean; it shall not have any preservatives or other coating / covering.

3.5 All rejected, decayed, bad quality wood shall be immediately removed from site.

3.6 All the dimensions mentioned for T.W. members are finished sizes.
All wood brought to site should be stacked, stored properly as per instructions.

4. Plywood

Plywood should be accordant as per the specification stipulated in bills of quantities.

Commercial Ply wood should generally confirm to IS 303 : 1989, bonded with Phenol formaldehyde, MR grade treated with wood preservative.

Particle boards should be phenol formaldehyde bonded and generally confirm to IS:3087 - 1965

Only 3mm to 4mm thick straight grain group matching approved veneers should be used. MDF if used in places as per specification should be conforming to IS:12406 - 1988

5. Hardware and Metals

5.1 The hardware throughout shall be of approved manufacture or supplier well made and equal to in every respect to the sample to be deposited with architect. The contractor may be required to produce and provide samples from many different sources before the SBI Life/Architect to take decisions and he should allow his rates for doing so.

5.2 All the screw/bolts with nuts to be used shall have oxidized finish (unless required otherwise) of approved shapes, size and quality.

5.3 Fittings shall be of brass oxidized heavy duty unless specified otherwise.

5.4 Samples of all hardware are required to be got approved in advance from Architects/SBI Life.

5.5 The agency should cover up and protect the brass surface by thick grease or other suitable material veneer as necessary and subsequently clean it away at the same time of handing over.

5.6 All hardware shall be fitted with good workmanship without the surrounding edges being damaged.

Aluminium and stainless steel shall be of approved manufacture and suitable for its particular application. Generally the surface of aluminium shall have an anodized finish and both shall comply with samples approved by SBI Life/Architects.

6. Laminate

6.1 All laminate shall be specified in Bill of Quantity and of approved make.

6.2 The contractor shall get the sample showing the surface texture, pattern and colour approved by SBI Life / Architect.

6.3 All edges, beading, etc shall also be finished in Lippings

7. Fabrication in Metal

7.1 All brazing and welds are to be executed in a clean and smooth manner, rubbed down and finished in flat and tidiest way, particularly where exposed.

8. Glass Works

8.1 All glass is to be of approved manufacture, complying with IS: 3548-1960, or as per approved quality and sample, to be of the qualities specified and free from bubbles, air holes, waviness and other defects.

8.2 In cutting glass, proper allowances shall be made for expansion. Each square or rectangle of glazing to be in one whole sheet.

8.3 Glass for mirror shall be silvering quality (5.Q.) conforming to 1.5.3458-1958 or as approved sample and quality.

8.4 On completion, all glass surfaces shall be cleaned inside and out. All cracked, scratched glass/ mirror shall be replaced.

8.5 Sun control film shall be non-reflective type, of approved make and shade. The fixing shall be without any defects such as air bubbles/ creases / adhesive marks, etc.

9. Paint and Polishes

9.1 All material required for the work shall be specified and approved manufacture, delivered to the site in the manufacture's containers with the seals, etc. unbroken and after use empty containers shall be stored till finally cleared by the Employer.

9.2 All iron or steel/metal surfaces shall be thoroughly scraped and rubbed down with wire brushes and shall be entirely free from rust, mill scale etc. before applying the primer coat.

9.3 Melamine polish finishes shall be properly finished, without any flow marks, spots, roughness etc.

Painting work shall be of high standard, without any brush marks on the finished surfaces and no spots on adjacent furniture, glass, etc.

Spray painting with approved machines will be permitted only if written approval has been obtained from the SBI Life/Architect prior to painting. Neither spraying will be permitted in the case of priming coat nor where the soiling of adjacent surfaces is likely to occur. The pressure and speed to be so operated has to give an even coating throughout to the satisfaction of the SBI Life/Architect. The paint used for spraying is to comply generally with the specification concerned and is to be specially prepared by the manufacture for spraying. Thinning of paint made for brushing will not be allowed.

All brushes, tools, pots, kettles etc. used in carrying out the painting works shall be clean and free from foreign matter and to be thoroughly cleaned out before use with a different type of class of material.

Prior to painting, the surface preparation should be done as per IS code IS 4177 1994 para 4.2.1, 5.2.1.1, 5.2.2.1, 5.2.3. In the case of maintenance operation, the surface preparation should be done as per para 7.00 of IS 14177:1994

For primer and finishing coat, the painting work should be carried out strictly as per 5.2.1.2, 5.2.1.3, 5.2.2.2 and 5.2.2.3 of IS Code.

Painting should be done invariably using airless spray equipment as per IS : 141771994 wherever recommended.

Proper care should be taken for deciding the compatibility of primer paint with paints used for finishing coats, including thinner on the basis of manufacturer's recommendation.

Enamel paint should conform to IS 133 - 2004

Wood filler, transparent liquid should conform to IS: 345 - 1952 (with amendment Nos. 1 and 2 reaffirmed 1986).

French Polish if to be done as per specific requirement should confirm to IS 348 1968 (First revision, with amendment Nos 1, reaffirmed 2001)

Painting on concrete, masonry and plastered surfaces should confirm to IS : 2395 (. pt - I) - 1994 (Operations workmanship re affirmed 2005)

Plastic emulsion painting for interior use should confirm to IS 5411 (Pt.I) - 1974 (with amendment No: 1, reaffirmed 1993)

10. Civil Work

10.1 The Contractor shall use cement of approved make only.

10.2 Only good quality ceramic tiles / vitrified tiles of approved make shall be used. All tiles joints shall be filled up properly using cement slurry mixed with matching pigments.

10.3 Only good quality granite and marbles / Veneer / ACP / Metallic Laminate of the basic rate specified and of approved shade shall be used. (Basic rates wherever mentioned are ex-go down and excluding taxes). The granite/marble shall be from the same lot and without colour / shade variations or any other defects.

10.4 All edge chamfers / cutting of granite / marble shall be mirror polished and no extra shall be paid for the same. In the case of Urinal partitions / sink partitions, the granite slab used for partition should be polished on both sides.

11. Upholstery

This will be of good call standard workmanship with webbing, no sag spring, coiled springs, padding and filling as specified on drawing. Covering fabrics will be seen tufted and corded as shown on the drawing and as approved by the SBI Life/Architect.

Cushion Vents- Brass Cushion vents should be installed at the back or under side of seat cushions (especially those covered in leather vinyl plastics or very tightly woven fabrics) to allow air to escape easily and to prevent tearing.

Materials- Finished timber shall be of the type specified. Furnishing fabrics, colour, pattern, substance to be as specified and manufacture, or supplied by the company specified, no variations of this will be permitted unless with prior approval of the consultants. The sample of the upholstery should be got certified from the SBI Life! Architect, before placing orders.

12. Polish

12.1 French Polish

The basic material shall be shellac dissolved non methylated spirit

The timber must be well sanded and clean and the grain filler. Any staining must be done before applying the polish.

By pad of cotton with soft white linen or cotton fabric, apply evenly over the surface with a slow figure of eight motion until the timber is coated with a thin layer of polish. Allow the work to stand for at least 8 hours, and the fresh rubber with double thickness of cover material and charges it with methylated spirit.

12.2 Wax Polish

Wax polish shall contain silicon and driers. A good silicon wax is to be used not a creamy or sprays. Timber shall be sealed first with another finish such as Ronseal, before applying wax.

Apply a light coat of the sealer by brush or cloth direct to the unfilled timber, working it well in and finishing evenly with the grain. Allow to dry thoroughly then sand lightly with fine paper. Apply a heavy coat of wax by cloth or on flat surfaces with a stiff brush. Work it well into the timber and finish off by stroking with grain before leaving to harden. Leave for several hours before rubbing up with a soft brush. Finally buff the grain with a soft cloth.

12.3 Transparent coloured Polyurethane (Melamine)

This shall be applied where natural grain of the wood is required to show. Polyurethane gives tough surface which resist chipping, scratching and boiling water . Clean off all grease and wax with an abrasive and white spirit, this should not be applied in humid conditions. Apply the first coat, preferably of clear hard glaze with a cloth pad. Leave this to dry for at least six hours, and then apply further coats with a paintbrush. If you wait for longer than 24 hours between coats, rub down the previous coat with fine glass paper or a medium grade steel wool. Obtain a matt finish, if required, by giving a final coat of clear Ronseal Matt Coat.

VIII MODE OF MEASUREMENTS

The measurements will be made in terms of relevant IS codes and will be made in meters and will be as per I.S code. The method of measurements for each item is as given under:

1. DOORS, WINDOWS, ROLLING SHUTTERS AND GRILLS

Clear area over one face inclusive of frame shall be measured. Hold fasts and portions embedded in masonry or flooring shall not be measured.

2 PARTITIONS IN WOODWORK

The partition height shall be measured up to bottom of false ceiling finished level and framing members / ply going above shall not be measured.

3 DECORATIVE PANELING OVER WALL OR OVER PARTITIONS

The area of cladding shall be measured in square meter, or square feet. The gross area cladded will be measured. No deductions will be made for gaps upto one centimeter between the panels

4. CARPETS

The actual area covered by the carpet shall be measured. No extra shall be allowed for wastage.

5. PAVING AND TILE WORK

The work mentioned in this section (shall be measured in Sq.ft or Sq.m. and shall be priced per unit of Sq. mt. In all paving work, the slabs shall be touching the walls and go well under the plaster, but the measurements shall be the clear measurements of the rooms or areas when finished. No allowance shall be made for portions going under the plaster. The wall dado will also be measured as per the clear measurements of the visible area only.

6. ALUMINIUM SLIDING WINDOWS

The measurement of aluminium sliding windows shall be taken only after the frame along with the shutter is fixed in its final finished position in line level and plumb. Width and height shall be measured net between the out of the aluminium window frames.

7. SHUTTERS, STORAGE UNITS, BOXING FOR ROLLING SHUTTERS etc.

The area will be measured in Sq.m on the actual facing size. No allowance shall be made for portions not visible.

8. TELLER COUNTER / UTILITY COUNTER, WALL MOUNTED WRITING LEDGE, PANTRY PLAT FORM, LUNCH PLATFORM SKIRTING etc

Will be measured in R.m on the actual length through the centre of the item if in curved profile.

9. FALSE CEILING

For false ceiling work, the measurement shall be for the actual area covered. The vertical faces will be measured as per the actual visible area. No deduction shall be made for the cutouts, for light fittings, speakers, column up to 1.5 Sqm.

2. PAINTING

The rates include all scaffoldings, ladders, paints, cans, brushes and other appliances required for the efficient execution of the work. The rates also include conveyance, delivery, handling, unloading, storing, wastage, protective cover and cleaning stains from floors and walls, glass panes etc and also preparatory works such as knotting, priming stopping and rubbing down, burning off or stripping etc.

The rates for special conditions of works not mentioned in the tender will be finalized by SBI Life / Architect considering site conditions and nature of specialty required, which will be final and binding on the contractor.

Measurements

No deduction will be made for openings not exceeding 0.5 Sq.m each and no addition will be made for painting to beadings, mouldings, edges, jambs, soffits, sill etc. of such openings.

Corrugated sheet surfaces will be included with plain surfaces after increasing their areas by the following percentages :-

- (i) Corrugated sheets 14%
- (ii) Asbestos cement sheets corrugated 20%
- (iii) Asbestos cement sheets semi corrugated:- 10%

Areas of uneven surfaces will be converted into equivalent plain areas in accordance with table given below:

Table of Equivalent Plain Areas of uneven Surfaces

Sl.No.	Description of work	How measured	Multiplying factor
1	Panelled or framed and brazed or ledged and battened or ledged, battened and brazed joinery	(not 11.30 (for Measured flat (not girthed) including frame. Edges, chocks, cleats etc. should be deemed to be included in this item	1.30 (for each side)
2	Flush joinery	Do	1.20 (for each side)
3	Fully glazed or gauged joinery	Do	0.80 (for each side)

4	Partly paneled and partly glazed or gauged joinery	Do	1.00 (for each side)
5	Fully Venetianed or louvered joinery	Do	1.80 (for each side)
6	Weather boards	Measured flat (Not girthed) supporting frame work shall not be measured separately.	1.20 (for each side)
7	Guard Bars, Balustades gales, gratings, grills, expanded metal and railings, gates and open for open palisade fencing including standard braces, rails stays etc .	Measured flat overall. No deduction shall be made for open spaces. Supporting members will not be measured separately.	1.00 (for painting all over)
8	Carved or enriched work	Measured flat	2.00 (for each side)
9	Steel rolling shutters	Measured flat (size of opening) overall, jamb guides, bottom rails and locking arrangement, etc., shall be included in the item (top cover will be measured separately)	1.10 (for each side)
10	Plain sheet steel doors and windows	Measured flat (not girthed) including frame, edges etc.	1.10 (for each side)
11	Fully glazed or gauged steel	Do	0.50 (for each side)
12	Partly Panelled and partly glazed steel doors.	Do	0.80 (for each side)
13	Collapsible gate	Measured flat (size of opening)	1.50 (for each side)

TECHNICAL SPECIFICATION FOR ELECTRICAL INSTALLATION WORK

MEDIUM VOLTAGE CABLES

SCOPE

Supply, installation, storing, laying, fixing, jointing, terminating, testing and commissioning of Medium Voltage PVC insulated PVC sheathed Armoured Aluminium/Copper Conductor Cables of reputed make, conforming to **relevant IS specification amended up-to-date** and specifications, laid in built up trenches, directly buried underground, on cable trays, in pipes, clamped directly to wall or structures etc.

GENERAL

All cables shall be of 1100 V PVC sheathed with or without steel armouring as specified and within outer PVC protective sheath. Cables shall have high conductivity stranded Aluminium or Copper conductors and cores shall be color coded to the Indian Standards

Medium voltage cables shall be aluminium/copper conductor, PVC insulated, PVC sheathed and steel wire flat armoured or. steel tape armoured construction. The cable shall have stranded, sector shaped aluminium conductors for cables of 4 Sq.mm size and above.

Core Identifications shall be provided with the following colour scheme of PVC

Single Core: Red/Black/Yellow/Blue

Two Core: Red and Black

Three Core: Red, Yellow and Blue

3 1/2 or 4 Core: Red, Yellow, Blue and Black

All cables shall be new without any kinks or visible damage. The manufacturer's name, insulating material, conductor size and voltage class shall be marked on the surface of the cable.

Standards

The following standards and rules shall be applicable

- | | | |
|----|-----------|--|
| a. | IS : 1554 | PVC insulated electric cables (heavy duty) |
| b. | IS : 1753 | Aluminium conductor for insulated cables |
| c. | IS : 3691 | Recommended current ratings for cables |

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Codes of Practice or the British Standard Codes of Practice where Indian Standards are not available

Inspection

All cables shall be inspected upon receipt at site and checked for any damage during transit and shall be supplied with complete manufacturer's test certificates. At any case, the cables shall not be accepted without test certificate.

Storing

All the cables shall be supplied in drums, with manufacturer's seal. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drum in vertical position.

Joints in Cables

The Contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoidance of cable jointing. This apportioning shall be got approved by the Consultant before the cables are cut in lengths. Where joints are unavoidable, the SBI Life/Architect/Consultant approval in writing shall be obtained about the location of such joints and marking shall be done with suitable tags.

Jointing Boxes for Cables

Cable joint boxes shall be of appropriate size, suitable for PVC insulated armored cables of particular voltage rating.

Joining Cables

All cable joints shall be made in suitable, approved cable joint boxes, and the filling in of compound shall be done in accordance with manufacturers' instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resin.

All cables shall be jointed colour to colour (should not be different colour); tested for continuity and insulation resistance before jointing. The seals of cables must not be removed until preparations for jointing are completed. Joints shall be commenced and finished on the same day. During the time of joining the cables, sufficient protection from the weather should be ensured. Joints shall be made by means of suitable solder/crimping of conductors, the conductors being firmly butted into the thimbles or ferrules and the whole conductors soldered/crimped with proper solder and soldering flux. The conductors shall be efficiently insulated with high voltage insulating tape and by using of spreaders of approved size and pattern. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

Bonding of Cables

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armoured clamp and gland. The clamps must grip the

armouring firmly to the gland or casing, so that no undue stress is passed on to the cable due to vibrations. The glands shall be fixed to the lead sheath by means of either a 'Plumbing joint' or a cone of approved material, capable of being compressed in to lead sheath. The gland or cone shall be capable of affecting a good electrical bond between both the armouring of the cable, and the casing

Installation

Cables shall be laid in the routes marked in the drawing. Where the route is not marked in the drawing, the contractor shall make it out on the drawing and also on the site and obtain the approval of the SBI Life/Architect/Consultant before laying the cable. Procurement of cable shall be on the basis of actual site measurement and the quantities shown in the Bill of Quantities shall be regarded as a guide.

Indoor

Cables rising indoor shall be laid on walls, ceiling, inside shaft or prepared trenches. The Cables run inside concrete trenches shall be supported on cable trays and shall be neatly arranged and clamped.

The Cable entries through pipes from outside to inside the building shall run in GI pipes and shall be sealed water tight with approved type of sealant to avoid water entering the building. Single cable laid shall be fixed directly to wall or ceiling with base clamp. All supports shall be fixed directly to walls or ceiling and the supports shall be at intervals of 500 mm. The cables on wall surface from panel board up to angle iron shall run in galvanized steel pipes of adequate size.

Where number of cables are run, necessary perforated cable trays shall be provided. The cable trays should be routed above false ceilings wherever provided. Cables laid in built-up trenches shall be on steel supports. Identification tags with reverse engraving plates shall be provided at intervals of 20 mts.

Cables shall be bent to a radius not less than 12 times the overall diameter of the cable, or in accordance with the manufacturer's recommendation whichever is higher

Outdoor

Cables shall be laid in outdoor trenches wherever called for. In case of direct buried cables, the cable route shall be parallel or perpendicular to roadways, walls etc. Cables shall be laid in excavated trench to a depth of 1000 mm, below the final ground level. The width of the trenches shall not be less than 450 mm. Where more than one cable is buried in one trench it should be laid in tier formation or with a coaxial distance of not less than 150 mm between the cables. Non corroding identification tags shall be provided on each cable at 10 meters centre to centre. In addition suitable galvanized / CI cable route markers should be provided over ground at all bends, intervals on straight runs at intervals of 20 meters centre to centre. The trenches shall be with uniform depth. Suitable shoring and propping may be done to avoid caving-in of trench walls. The floor of the trench shall be rammed to level. The cables shall be laid in trenches over rollers placed inside the trench.

The cable drums shall be laid unrolled in the direction of the arrow marked on the drum for unrolling.

After the cable is laid and straightened, it shall be covered with 80 mm thick layer of sand. The cable shall then be lifted and placed over the sand cushion. Over this, 75

mm thick layer of sand shall be covered and a course of cable protection tiles or burnt brick (both on sides and top) shall be provided to cover the cables by 50 mm on either side. The cable trench shall be backfilled with excavated earth and consolidated as original. Excess earth shall be removed the site free of cost. Cables shall be laid in Hume pipes/stoneware pipes at all road crossings and in GI pipe at the wall entries. Cable route markers to be provided as per standards.

All apparatus, connections and cable work shall be designed and arranged to minimize the risk of fire and any damage, which might be caused in the event of fire. Wherever cables pass through floor or wall openings or their partitions suitable bushes of an approved type shall be supplied and put in to position by the contractor. If required by the Engineer, the Contractor shall seal the cables into the bushes using fire-resisting materials to prevent the spreading of fire through each partition.

Inspection on receipt, unloading, storage and handling of cables shall be in accordance with IS: 1255 and other Indian Standard Codes of Practice.

Standard cable grips and reels shall be utilized for cable puffing. If unduly difficult pulling occurs, the Contractor shall check the pull required and suspend pulling until further procedure has been approved by the Engineer. The maximum pull tension shall not exceed the recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering & does not set up undesirable conditions of electrostatic stress or electrostatic charge may be used to assist in the pulling of insulated cables in conduits and ducts.

After pulling the cable, the Contractor shall record cable identification and date pulled neatly with waterproof ink on linen tags and shall securely attach such identification tags. Identification tags shall be attached to each end of each cable with non-corrosive wire. The said wire must be non-ferrous material on single conductor power cable. Tags may further be required at intervals on long runs of cables on cable trays and in pull boxes. Cable and joint markers and RCC warning covers shall be provided wherever required.

Sharp bending and kinking of cables shall be avoided. The bending radii for various types of cables shall not be less than those specified below:

1.1 kV XLPE Multicore armoured cables: 15 times the overall dia of the cable.

11.650/1100V PVC Insulated cable. : 10 times the overall dia of the cables.

If shorter radius appears necessary, no bend shall be made until clearance and instructions have been received from the Engineer's Representative.

Power and control cables shall be laid in separate cable racks/trays.

Where groups of LV and control cables are to be laid along the same route, suitable barriers to segregate them physically shall be employed.

When power cables are laid in the proximity of communication cables, minimum horizontal and vertical separation between power and communication cables shall be normally 600 mm, but in any case not less than 460mm for single core cables and 300mm for Multicore cables. Power and communication cables shall as far as possible, cross at right angles to each other.

Where cable cross roads and water, oil, gas or sewage pipes, the cables shall be laid in reinforced spun concrete or steel pipes. For road crossings the pipe for the cable shall be buried at not less than one-meter depth.

Cable laid in ground shall be laid on a 50mm riddled earth bed. The cables shall then be covered on top and at their sides with riddled earth to a depth of about 150mm. This is then gently rammed up to a depth of about 100 mm above the top of uppermost cable covers which are placed centrally over the cables. The protective cable covers for LV cables may be of earthenware. The specification of protective covers shall be generally as per Appendix 'C' of IS: 1255. The RCC covers shall have one hole at each end, to tie them to each other with GI wires to prevent displacement. The trench is then back filled with the-excavated soil and well rammed in successive layers of not more than 300. mm in depth, with the trenches being watered to improve consolidation where necessary. To allow for subsidence, it is advisable to allow a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench.

Each cable shall be pulled into the particular conduit and shall be taken from the particular reel designated for the run. All cables shall be neatly trained without interlacing. In hand holes, pull boxes or junction boxes having any dimension over 1000mm, all conductors shall be cabled and/or racked in an approved manner care shall be taken to avoid sharp bending or stressing cable beyond manufacturer's recommendations in pulling. Cable shall be protected at all times from mechanical injury and from absorption of moisture at unprotected ends.

In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop a fault at later date.

Cables on cable racks, on cable trays and in conduits shall be formed to avoid tearing against edges or trays, racks, conduits or their supports upon entering or leaving trays, racks or conduits. Cables shall be locked or laid directly into cantilevered cable trays where practicable, but in some cases it may be necessary that cables are pulled or threaded into trays. To facilitate visual tracing, cables in trays shall be laid only in single layers and unnecessary crossing of cables shall be avoided. Cables on trays shall finally be clamped in an approved manner.

Cable splices will not be permitted except where permitted by the Engineer. Splices shall be made by the Contactor for each type of wire or cable In accordance with the instructions Issued by cable manufacturers and the Engineer. Before splicing, insulated cables shall have conductor insulation stepped and bound or penciled for recommended distance back from splices to provide a long leakage path. After splicing, insulation equal to that on the spliced conductors shall be applied at each splice.

At cable terminal points where the conductor and cable insulation will be terminated, terminations shall be made in a neat, workmanlike and approved manner by men specialized in this class of work. The Contractor shall make terminations for each type of wire or cable in accordance with instructions issued by cable manufacturers and the Engineer,

Control cable terminations shall be made in accordance with wiring diagrams, using colour codes, numbering ferrules approved by the Engineer for the various control circuits, by code marked wiring diagrams.

When control cables are to be fanned out and cabled together with cord, the Contractor shall make Connections to terminal blocks, and test the equipment for proper operation

before cables are corded together. If there is any question as to the proper connection, the Contractor shall make a temporary connection with sufficient length of cable so that the cable can be switched to another terminal without splicing. After correct connections are established through operating the equipment, cables shall be cut to their correct lengths, connected to terminals in the specified manner, and corded together where necessary to hold them in place in a workmanlike manner.

Jointing of cables shall be in accordance with relevant Indian Standard Codes of Practice and manufacturer's special Instruction. The Contractor shall supply materials and tools required for cable jointing work, including cold setting bituminous compound. Cables shall be firmly clamped on either side of a straight through joint at a distance of not more than 300mm away, from the joints. Indication tags shall be provided at each joint and at all cable terminations.

Cable seals shall be examined to ascertain if they are intact and that cable ends are not damaged. If the seals are found to be broken the cable ends shall not be joined until after due examination and testing by the Engineer. Before jointing commences, insulation resistance of both sections of cable to be joined shall be checked by meggar.

After installation and alignment of motors, the Contractor shall complete the conduit Installation, including a section of flexible conduit between the motor terminal box and cable trench / tray. The Contractor shall install and connect the power, Control and heater supply cables as per equipment manufacture's drawings if any. The Contractor shall be responsible for correct phase sequence of the motor power connections and shall interchange connections at the motor terminal box if necessary, after each motor is test run.

Connections to recording instrument, float switches, level electrodes, limit switches, pressure switches, thermo-couples, thermostats and other miscellaneous equipment shall be done as per manufacturer's drawings and instructions.

Metal sheath and armour of the cable shall be bonded to the earthing system of the station. The size of conductor for boning shall be appropriate with the system fault current.

POWER AND CONTROL CABLE TERMINATIONS

All cables shall be full runs from panel without any joints. Cables shall be identified at end terminations indicating the feeder number and the Panel/Distribution Board from where it is being laid. All cable terminations for conductors up to 4 sq.mm may be insertion type and all higher sizes shall have tinned copper/aluminum compression lugs as specified. Cable termination shall have necessary single/double brass compression gland as specified and the end terminations shall be insulated with a PVC tape

Cable boxes shall be of approved design with adequate clearances between phases and between phases and earth, in accordance with relevant standards.

Cable boxes shall be complete with combined armour and earthing clamps.

Suitable compression type cable glands shall be provided for power and control cables.

Provision shall be made for earthing the body of each cable box.

Equipment terminal blocks for power connections shall be complete with adequate phase segregating insulating barriers and suitable crimping type of lugs for connecting the insulated cable tails.

Testing of Cables

TESTS

The cables shall be tested in accordance with the IS: 684/1554/7098. The tests shall include

PVC insulated cables (for voltage up to 1100V:IS 684

PVC insulated cables (heavy duty): IS 1554.

Cross-linked polyethylene insulated PVC sheathed cables: IS 7098.

Cable Insulation Tests shall be conducted between phases and between phase and earth for each length of cable, before and after jointing. As such all phase cables may be checked before being laid for above tests. On completion of cable laying work, the following tests shall be conducted in the presence of the ank/Consultant.

Construction tests

Test for conductors
Test for thickness of Insulations
Test for laying up
Test for thickness of laying up
Test for thickness of inner sheath
Test for armouring
Test for thickness of outer sheath
Insulation Resistance Test (sectional and overall)
Continuity resistance test.
Sheathing continuity test.
Earth test.

All tests shall be carried out in accordance with relevant Indian Standard Code of Practice and Local Electricity Rules. The Contractor shall provide necessary Instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Consultant/Employer.

The contractor shall install, test and commission the cables in accordance with technical specification and drawings approved by the Engineer. Cables shall be laid directly buried in earth, or cable racks, in build up trenches, on cable trays and supports, in conduits and ducts or bare on walls, ceiling etc. as per approved drawing. Contractor's scope of work includes unloading, laying, fixing, joining, bending, and terminating of the cables. The Contractor shall also supply the necessary materials and equipment required for joining and terminating the cables.

All new cables shall be meggar tested before joining is completed. LV cables shall be muggy tested. 1100/650 volt grade cables shall be tested by 1000 Volt meggar.

Cable cores shall be tested for

Continuity

Absence of cross phasing

Insulation resistance to earth

Insulation resistance between conductors.

Contractor shall furnish all testing kit and instruments required for field-testing.

CONDUITS, PIPES AND DUCTS

The Contractor shall supply and install conduits, pipes and accessories as per requirement. All accessories required for making the installation complete, including but not limited to, ordinary and inspection tees elbows check nuts, male and female reducers and enlargers, wooden plugs, caps, square headed male plugs, nipples, gland sealing fittings, junction boxes, pull boxes, conduits, outlet boxes, splice boxes, terminal boxes, glands, gaskets and box covers, saddles and all steel supporting work shall be supplied by the Contractor. Conduit accessories shall be of the same material as the conduits.

Flexible metallic conduits shall be used for termination of connections to equipment such as motors or other apparatus to be disconnected at periodic intervals. Flexible metallic conduits shall also be used for termination of connections to level switches, level electrodes, limit switch, pressure, pressure switches etc. All flexible metallic conduits shall be provided with end glands.

Conduits or pipes shall run along walls, floors, and ceilings, on steel supports, embedded in soil, floor, wall or foundation, in accordance with approved layout drawings.

Exposed conduit shall be adequately supported by racks and clamps or straps or by other approved means. Conduit supports shall be erected square, and true to line and grade with an average spacing of one support for every 750 mm of conduit length.

Each conduit run shall be marked with its designation.

All installed conduits shall have their ends temporarily closed by caps, wooden plugs, or other approved means until cable is pulled. Closures shall be made in such a way that they do not get dislodged easily.

When one or more cables are strained through a conduit, conduit size shall be such that the total cross sectional area of the cable does not exceed 60% of the internal cross sectional area of the conduit.

The Contractor shall be responsible for bonding of metal pipes or conduits in which cables have been installed to the main earthing system. Joints, metal sheath and armour of cables shall be bonded to the earth system in an approved manner. The entire system of conduit after installation shall be tested for mechanical and electrical continuity throughout and permanently connected to earth by means of a special approved type-earthing clamp efficiently fastened to the conduit. Gas or water pipes shall not be used as an earth medium.

DISTRIBUTION BOARDS

SCOPE

Supply, erection, testing and commissioning of standard make distribution boards conforming to relevant Indian standards (IS 8623) and specifications given below.

GENERAL

Distribution Boards Shall Consist of Following.

MCBs/ELCBs/ELMCBs of reputed make and designed capacity, which shall conform to IS 8878 latest.

Neutral strip/earth strip for connecting all distribution point neutral/earth wires of serial room.

Two numbers brass bolts and nuts on DB base for it's earthing.

Cable conduit entry boxes on top and bottom as per design drawing.

However the specifications herein after described shall take precedence over the above wherever this specifications call for a higher standard of material or workmanship. The distribution boxes shall be of standard factory make and flexibility shall be given to mount MCBs/ELCBs/ELMCBs of any make.

CABINET DESIGN

Distribution boards shall be of totally enclosed type with dust and vermin proof construction. The enclosure shall be made of steel sheet of 16SWG. The steel sheet shall be treated with a rigorous rust inhibition process before fabrication. The distribution boards shall consist of Earth leakage / Miniature Circuit Breaker as in-comer and required number of Miniature Circuit Breakers as outgoing. The distribution boards shall be with top and bottom cable/conduit entry. The incoming and outgoing shall be rated as specified on the drawings and schedule; and both shall be totally isolated from one another. The cabinet shall be spray enameled to required colour shade finish. The interior components of the DB shall be mounted on Din Rails, mounted on the studs provided inside the cabinet. A cover made of hylam sheet, or spray enameled 16SWG steel sheet, shall be provided over the cabinet with slots for operating knobs or breakers.

The cabinet shall be equipped with 16SWG inside hinged front door having a spring latch and lock over flanged door. Cabinets shall have detachable gland plates at both top and bottom made out of 16SWG. The hinged type door shall be with 'U' shape edge to provide Square type compressed rubber gasket.

The construction of the hinges shall be as to enable the door to swing open by not less than 150degree. In addition to this, the hinged design shall permit doors being completely removed whenever necessary.

MINIATURE CIRCUIT BREAKERS (MCB)

Miniature circuit Breakers shall be quick Make and Break type, and shall conform to relevant Indian Standards. The housing shall be heat resistant and shall have high

impact strength. MCBs shall be flush mounted and shall be provided with trip free manual operating lever and 'ON' and 'OFF' indications. The contacts shall be provided with magnetic and thermal releases for short circuit and over current. The device shall have a common trip bar in the case of DP and TPN Miniature Circuit Breakers.

MCB for ratings up to 125 Amps shall be available in 1,2,3 or 4 pole versions. MCB casing shall be made of self-extinguishing material tropicalised treatment 2 (relative humidity) 95% at 55°C).

MCB shall comply with IS 8828-1996/IEC 898 -1995.

It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC/DC supply according to requirements.

Arc chutes should be provided for effective quenching of arc during operations and fault conditions.

It shall have trip free mechanism and toggle shall given positive contact indication.

It shall be suitable for mounting on 35mm DIN rail/surface mounting.

Line supply may be connected to either top or bottom terminals i.e. there shall be no line load restriction.

Degree of protection, when the MCB is flush mounted, shall be IP40.MCB & shall be supplied with clamping terminals fully open.

Contact closing shall be independent of the speed of the operator.

MCB's operating temperature range shall be -20 deg C to + 60 deg C.

The characteristics should be in accordance with IS 8828 -1996. The breaking capacity of the MCB shall be 10kA and energy limiting class3.

The rated impulse voltage of the MCB shall be greater than 4kV.

The MCB shall be capable of being used as Incomer circuit breaker and shall be suitable for use as an isolator.

Contact closing shall be independent of the speed of the operator.

Electrical endurance of the MCB shall be greater than 4kV.

Power loss per pole shall be in accordance with IS 8828-1996 and the manufacturer shall furnish the same

In case of multipole MCBs in a single location (DB) it shall be possible to remove MCB without having to disturb other MCB's in the vicinity.

'C' curve type MCB should be used for lighting loads, 'C' curve type for motor loads and 'D' curve type for UPS circuits.

RESIDUAL CURRENT CIRCUIT BREAKER (RCCB)

RCCB shall comply With IS 12640-1988 IEC1008. It shall be available in 2 pole and 4 pole versions and threshold sensitivities (non-user adjustable) of 30m A, 100m A & 300mA with inbuilt time delay of 200mS for discrimination with downstream ELCB, if specified in schedule of quantities. Tropicalisation : treatment 2 (relative humidity 95% at 55°C).

The current rating shall be from 25A, 40A and 63A. Ratings and sensitivities shall be as specified in schedule of quantities.

It shall be operationally independent of line voltage.

There shall be clear Identification of earth fault or overload/short circuit fault on the RCCB.

The RCCB shall not give nuisance tripping due to transient over voltages (lightening line disturbances or other equipment).

The RCCB should preferably be 'Si' class type (should be suitable for SMPS loads i.e. unaffected by the D.C pulsated components present if any in the circuit), and should not give nuisance ripping. Details to be furnished confirming suitability.

The short circuit withstand capacity of the RCCB without the associated short circuit/overload protection should preferably be 6kA.

A test device should be incorporated to check the integrity of the system and tripping mechanism.

Terminals should ensure easy termination of cables and should provide rovers to shield Incoming and outgoing tenninals with IP20 degree of protection.

The RCCB should be suitable for DIN rail mounting.

INDICATING LAMPS

Type	: Panel mounting "Protected LED" types. (I.e. protection is provided against Electromagnetic interference &. over Voltage)
Standard applicable	: IEC 947-5-1
Eclectic shock protection	: class 2(IEC 536)
Degree of protection	: IP 65(IEC 529)
Diameter	: 22mm
Voltage	: 230V AC

TERMINALS

Distribution Boards shall be provided with a terminal block for neutral and earth terminations of adequate size. The terminal block shall be so located as to prevent crowding of wires in the proximity of live parts.

DIRECTORY

Distribution Boards shall be provided with a directory indicating the areas of loads served by each Circuit Breaker, the rating of breakers, size of conductors, etc. The directory shall be mounted in metal holder with a clear plastic sheet on inside surface of the front door. A suitable size "Danger" plate indicating voltage grade shall also be fixed inside the DB front cover.

INSTALLATION

Distribution Boards shall be wall / surface mounted or recess mounted as required and at the locations shown on the drawings. The Boards shall be fixed on 30 x 40 x 6mm angle iron framework and bolts for surface installation. All the cables/conduits shall be properly terminated using glands/grips/check nuts, etc. Wiring shall be terminated properly, using crimping lugs / sockets and PVC identification ferrules. No bare conductor shall be provided inside the board.

Distribution boards shall be bonded to the earthing system at least at two points using brass bolts and lugs.

WIRING SYSTEM

SYSTEM OF WIRING

The system of wiring shall consist of PVC insulated copper conductor wires in MS conduits as per IS 9537 part II for concealed installation.

GENERAL

Prior to laying and fixing of conduits, the Contractor shall carefully examine the drawings indicating the layout and justify himself about the sufficiency of number and size of conduits, location of Junction boxes, size and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Consultant / Employer. Any modifications suggested by the Contractor shall be got approved by the consultants before the actual laying of conduits is commenced.

CONDUITING MATERIALS

All concealed and surface electrical wiring installation shall be in MS conduits.

PVC CONDUITS

Conduits and accessories shall conform to IS 9537-Latest and the specifications given below. PVC conduits shall be of black, round, heavy gauge Polyvinyl Chloride (PVC). The internal surface of the conduit shall be smooth. All flexible conduits shall be of steel. Only approved quality as recommended by the consultant and factory made bends / accessories shall be used.

METAL CONDUITS

Conduits and Accessories shall conform to IS 9537 (Latest) and tender specifications. The steel conduits shall be solid drawn, mild steel, 16 gauge, heavy duty electrical welded, thread type, having perfect circular tubing with tight fitting joints and shall be capable of being cleaned easily. The conduit shall be protected from rust by one coat of paint applied inside and outside in its manufactured form.

Minimum Conduit Dia (OD) For electrical Wiring shall be 20 mm.

Minimum Conduit Dia (OD) For Telephones and Audio Video shall be 20 mm

Joints between conduits and accessories shall be securely made, to ensure earth continuity. Where called for, buried wiring passing underground, shall be in galvanized steel conduit.

The conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer. This shall be approved by respective Engineer-In-charge and same shall be submitted along with bills for payment.

The number of 650/1100 volts grade PVC insulated copper conductor wires that may be drawn in the conduits of various sizes are given below. The space occupied by the wires shall not exceed 60% of the conduit Internal Area and 40% of conduit space should be left free.

Maximum permissible number of 650 / 1100 volt grade PVC insulated wires that may be drawn into rigid non-metallic or MS conduits are given below:

Size of wire in Sq.mm	Maximum Number of Wires within conduit size (mm)				
	19	25	32	38	51
1.5	3	6	10	14	-
2.5	2	5	10	14	-
4.0	-	3	5	8	14
6.0	--	2	4	5	8
10.0	-	-	3	4	6
16.0	-	2	2	3	4
25.0	-	-	-	1	3
35.0	-	-	-	1	2

BENDS IN CONDUIT

Conduit bends shall be of 16 SWG. Where necessary, bends or diversions may be achieved by means of bends and/or circular inspection boxes with adequate and suitable inlet and outlet terminations. In case of recessed system each junction work shall be provided with a cover properly secured and flush with the finished wall surface. No bends shall have radius less than 22 times the outside diameter of the conduit. Ready-made bends shall be used where required.

Run of conduit pipes through expansion joints in RCC member should be avoided as far as possible, and if unavoidable, flexible conduit pipe shall be used with ceiling outlet box on both sides of expansion joints, after getting approved from the Consultant. Outlet boxes for lights/fans shall be protected at the time of laying by fitting with jute/earth/cotton etc.,

Locating junction boxes on outer surface of exterior walls of building should be avoided to prevent exposure to weather as also to preserve aesthetics. Junction boxes should never be closed permanently by plaster. The contour of the boxes should match the colour of the wall.

Junction boxes inside the guest room/areas shall be avoided. In case these are unavoidable they can be located in corridor / service areas / staircase, etc. One bolt shall be welded to receive earth wire inside all switch points. The switch points shall be fixed at a level accessible from floor level. Conduits in wall crossing area shall be sealed with M-Seal/epoxy compound after pulling the wires.

SWITCH OUTLET AND JUNCTION BOXES

All concealed outlet boxes for switches, sockets and other purpose shall be rust proof and shall be of thick Galvanized steel (GI) boxes having smooth external and internal surfaces.

All outlet boxes for receiving plug sockets and switches shall be of standard factory make and of approved size, and shape. All boxes shall have- adequate number of knock out holes of required diameter and earthing terminal screws. Outlet boxes shall have a minimum depth of 65 mm.

INSPECTION BOXES

Rust proof inspection boxes of 2 mm thick mild steel having smooth external and internal finish shall be provided to facilitate removal and replacement of wires, where required.

WALL SOCKET OUTLETS

Following types of socket outlet shall generally be used for interiors

- 6A 2/3 pin socket outlets
- 6/16A socket outlets
- 20A metal clad socket 230V/440V
- 25A Heavy duty socket outlets

All sockets shall be of shutter type.

All electrical points shall be installed as per approved layout. The insulated earth wires shall be run in each conduit originating from the distribution board up to the light, socket and switch boxes. If the Electrical Contractor fails to install any conduit / boxes etc., before the plastering / painting work is done by other agencies, he may be permitted to install the same with prior permission of Consultant and the expenses towards redoing the wall, floor, ceiling etc., shall be borne by the Electrical Contractor.

OPEN/SURFACE CONDUIT SYSTEM

Conduits on surface of walls/Ceiling shall be fixed on the route as approved by SBI Life/Architect/Consultant. Heavy gauge GI saddles shall be used for fixing the conduit. Distance between two consecutive saddles shall not exceed 750 mm. No wooden plug for fixing saddles / clamps shall be used. Use of Rawl plug / steel fastener with hard setting / scaling compound is recommended. Conduits shall be run in horizontal and vertical lines. Wherever couplers, bends, or similar fittings are used, saddles shall be provided at either side at a distance of 300 mm from the center of such fittings. Conduits shall be joined by means of screwed couplers and screwed accessories only. In long distance straight runs of conduit, inspection type couplers / junction boxes shall be provided.

Threading shall be long enough to accommodate pipe to the full threaded portion of the couplers and accessories. Cut ends of conduits shall have no sharp edges nor any burrs left, to avoid damage to insulation of wires.

Bends in conduit runs shall be done by using pipe-bending machine. Sharp bends shall be accomplished by Intruding solid bends, Inspection bends or cast Iron/ MS Inspection boxes. Radius of solid bends shall not be less than 75mm. Not more than 90-degree bend shall be used in a conduit run from outlet to outlet.

All conduits opening shall be properly plugged with PVC stoppers / bushes. Conduits shall be adequately protected against rust by applying two coats of approved synthetic enamel paint over a coat of primer after the installation is completed and should be certified by the Architect/Consultant.

Wherever conduits terminate into control boxes, outlet boxes, distribution boards etc., it shall be rigidly connected to the box with check nuts on either side of the entry.

Conduit run in the floor/wall should be embedded using cutting machine and manual cutting should be totally avoided. Chicken mesh should be provided when the number of conduits exceeds two in a row. The scope also includes rough plastering after embedding the conduit in the floor/wall.

The entire conduit system shall be bonded to the earth.

WIRING

All wires shall have been manufactured in accordance with the latest IS Specification (IS 694 - Part II).

All wires shall be PVC insulated, copper conductors of 650-volt grade. Cross section of the conductor shall be as per the specification mentioned in schedule of quantities.

Minimum cross section of conductor for electrical wiring shall be 1.5 mm square.

For single-phase wiring, the colour of the insulation of phase conductors shall be Red / Yellow / Blue and black for neutral. The colour coding adopted should be uniform for the entire Project.

Earthing is to be done by Green PVC insulated copper conductor. For three phase wiring, the insulation of phase conductors shall be Red/Yellow/Blue, as per relevant phase and Black for neutral.

Earth wire shall always be of copper conductor PVC insulated and colour of insulation shall be Green

Whenever wires are being terminated in a Distribution Board / Switch Box / socket outlet point etc., a minimum of 300 mm long extra wire should be provided in the form of a loop for further maintenance use.

For each lot of wires, the Contractor shall submit all relevant test certificates issued by the Manufacturer stating its origin, date of manufacture, constitution and standards to which it complies. All wires and cables shall bear the manufacturer's label and shall be brought to site in original packing.

Only Authorized/certified wiremen and cable jointers shall be employed to do the cable jointing work

Wires shall not be jointed inside the conduit or pull boxes. Where unavoidable, joints shall be made through approved mechanical connectors with prior permission of Employer/Consultant. Control switches shall be connected in the phase conductors only; and shall be 'ON' when knob is down. Switches shall be fixed in galvanized steel boxes. Chromium plated screws shall be used. Power wiring shall be distinctly separate from lighting wiring.

Each circuit phase wire from the distribution boards should be followed with a separate neutral wire of the same size as that of the circuit wire.

Wires originating from two different phases shall not run in the same conduit.

DRAWING CONDUCTORS

The drawing and jointing of PVC insulated copper / aluminum conductor wires and cables shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches, etc., Care shall also be taken to ensure that the insulation is not peeled off either in portions or as a whole; and the conductor is not broken anywhere. There shall be no sharp bends that may lead to the breakage of the conductor.

PVC Insulated copper conductor wire ends shall be soldered (at least 20 mm length) before inserting into the switch for termination. Conductors having nominal cross sectional areas exceeding 6 Sq.mm shall always be provided with cable sockets / lug of same material as that of conductor.

Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional area to take all strands and shall be soldered. Connecting brass screws shall have flat ends. All looped joints shall be soldered and connected through block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.

At all bolted terminals, brass flat washer of large area and approved size spring shall be used. Brass nuts and bolts shall be used for all connections.

For all internal wiring, PVC insulated wires of 650 / 1100 volts grade shall be used.

The sub-circuit wiring for point shall be carried out in loop in/loop out system and no joints shall be allowed in the length of the conductors. If the use of joint connections are unavoidable due to any specific reason, prior permission, in writing, shall be

obtained from the Employer / Consultant. No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of wire. Before the wires are drawn into the conduits, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other construction debris, by forcing compressed air through the conduits. All sub-circumstances for light points shall be with 2.5 Sq.mm PVC insulated copper conductor.

JOINTS

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to outlet.

MAINS AND SUB-MAINS

Mains and sub-mains cable or wires where called for shall be of the rated capacity and approved make. Every main and sub-main wire shall be drawn into an independent adequate size conduit. An independent earth wire of the proper rating shall be provided for each sub main, one earth wire of proper rating shall be provided for every single-phase sub main. For every 3-phase sub main, two earth wires of proper rating shall be provided along with the sub main. The earth wires shall be fixed to conduits by means of clips at not less than 1000mm distance. For mains and sub-mains extra lengths of cable shall be provided to facilitate easy connections and maintenance

LOAD BALANCING.

Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

COLOUR CODE OF CONDUCTORS

Colour code shall be maintained for the entire wiring installation as red, yellow, blue for three phases, black for neutral.

MEASUREMENTS

POINT WIRING

All outlets connected on a lighting point shall be measured under point wiring. It shall include wiring from first switch point of the circuit up to light, fan, socket outlet via switches, regulators, controls etc., as called for. Generally, the following accessories shall be included.

Light outlet box with ceiling rose

Lamp holder

Switches

6/16 A socket outlets with plug tops

M.S./G.I outlet box

Fan hook

Fan regulator.

Small wiring from outlet to Fan Light

Conduit and accessories

PVC copper conductor wires

CIRCUIT MAIN FOR LIGHT CIRCUIT

Circuit main is measured in length from the Distribution Board up to the first switch point on that circuit only; from this point onwards, all looping will be measured under point wiring.

GENERAL

Point wiring and circuit wiring should be done in independent conduits and should not be taken through the same conduit.

Fan regulator box, fans, light fittings, calling bells are to be properly earthed. In respect of 6 Amps conventional plug point, the third pin should be earthed with 2.5 Sq.mm green PVC Insulated copper wire.

All flush type switches and accessories will be used with 3-mm thick hylam sheet in MS box.

For the purpose of determining the load per circuit The following electric rating of points shall be assumed. this Group lighting Board would always be from DB of size as specified In schedule of quantities." Group lights" points would commence from DB including circuits, surface / concealed conduit system, necessary wiring, MS switch box H.C.B, hylam sheet cover and outlet box up to lost light of the group.

SLNO	DESCRIPTION	WATTAGE
1	LIGHT POINTS	60
2	CONVENTIONAL PLUG POINT 5A power point	100
3	FAN POINT	60
4	EXHAUST FAN POINTS	60
5	CONVENTIONAL PLUG POINT 16A power point	1000

Light, fans and 6 A point shall be wired on a common circuit. Each circuit shall not have more than a total of ten points of lights, fans and 6 A socket outlets or a load of 800 watts whichever is less. The ceiling fan point shall be complete with special outlet box including fixing and connection of regulator. Supply and fixing of 6A switch for each ceiling fan is included in scope of Contractor.

For 16A POWER PLUG POINTS

In one circuit, there shall not be more than two 16A power plug points and circuit shall be connected by 2 x 4 Sq.mm, 1 x 1.5sqmm or 3 x 4sqmm copper conductor wires.

One flush type plug socket outlet and switch shall be fixed for each power point on 3 mm thick hylam sheet cover. Plug socket can be standard type or 16 / 6 A universal type as shown in the diagram. The circuit main would commence from DB and end up to the switch box. Looping of circuit would be done to second 16A power point from first 16A power point and shall be counted as power point wiring.

Each circuit would have its own 2.5 Sq.mm green PVC insulated copper wire from DB to switch box and would be connected to third pin of socket outlet.

5. EARTIING

SCOPE

Supply, fabrication, Installation, testing and commissioning of earth pits. Conforming to relevant IS Specifications and standards. The scope includes all related civil work for making pit, providing suitable covers and with identifications marks etc

GENERAL

All the non-current carrying metal parts of electrical installation shall be earthed as per IS: 3043. All equipments, metal conduits, rising mains cable armour, switch gear, distribution boards, meters, cable glands 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 be in conformity with the provisions of Rules 32, 61, 62, 67 and 68 IER 1956.

CONSTRUCTION

GI Pipe Earth Station

Electrodes shall be made of GI pipe of Internal Diameter of 38mm. The pipe electrode shall be as far as practicable embedded below permanent moisture level. Pipes shall be driven to a depth of at least 2.5/3 Mtr as specified. The electrode of Earth Pit may be buried inclined to the vertical. The inclinations shall be not more than 30° from the vertical. The pipe electrode shall be made of one piece. Earth leads to the electrode shall be laid in a heavy-duty GI pipe and connected to the pipe electrode with brass bolts, nuts and washers, with a suitable size clamp on top. GI pipe shall be terminated in a wire meshed chamber of 450mm x 450mm. The chamber shall be provided with a frame and an inspection cover. The earth station shall also be provided with a suitable permanent identification label tag. The soil around the earthing electrode shall be

treated to reduce the resistivity of the soil by filling the complete depth of electrode with alternative layers of charcoal and salt.

Copper Plate Earth Station

Plate electrodes shall be made of 3mm thick (UPS Earthing) copper plate of 600 x 600 mm size. The plate shall be buried vertically in ground to a depth of not less than 2.5/3 meters as specified to the top of the plate. The pit should be filled with charcoal in such a way that the electrode is encased to a minimum thickness of 300 mm all-round. The electrode, to the extent possible, should be buried to a depth where subsoil water is present. Earth leads to the electrode shall be laid in a heavy-duty GI pipe and connected to the plate electrode with brass bolts, nuts and washers.

A GI pipe of not less than 20mm dia. shall be clamped with bolts vertically to the plate and terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 450 mm x 450 mm dimensions. The chamber shall be provided with GI frame and inspection cover. The earth station shall also be provided with a suitable permanent identification label tag.

EARTHING CONDUCTORS

All earthing conductors shall be of high conductivity copper / G.I strips and shall be protected against mechanical damage and corrosion. The connection of earth electrodes shall be strong, secure and sound and shall be easily found. The earth conductors shall be rigidly fixed to the rolls, cedar tranches, cable trays, conduits and cables by using suitable clamps.

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 of the medium voltage network.

Earthing conductors shall be run from the exposed metal surface of the equipment and connector to a suitable point on the sub main or main earthing bus. All switch boards, Distribution Boards, Disconnecting Switches and Isolators shall be connected to the earth bus. Earthing conductors shall be terminated at the equipment end using suitable lugs, bolts, washers and nuts.

All conduits, cable connecting etc., shall be connected to the earth along their run by earthing conductors of suitable cross sectional area. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary through a fuse / protective device and circuit breaker and shall not exceed 2 ohms

PRECAUTIONS

Earthing shall be mechanically robust and the joints shall be capable of retaining low resistance always. Joints shall be tinned, soldered and double riveted. All the joints shall be mechanically and electrically continuous and effective. Joints shall be protected against corrosion

The following table gives an idea on selection of size of earth conductors for electrical equipments such as Transformers, Motors, Generator, Switch gear, Cable Glands, etc.,

SCOPE

The specification covers the installation, testing and commissioning of all electrical equipments and accessories required for the switchyard for efficient and trouble free operation.

STANDARDS

The electrical Installation work covered by this specification shall unless otherwise stated comply with the requirements of the latest edition of relevant Indian Standard, statutory regulations and codes of practices.

IS - 3043: Code of practice for earthing.

IS – 2309: Code of practice for protection of building and allied structures against lightning

IS - 2274: Code of practice for electrical wiring installation.

GENERAL REQUIREMENTS

The installation shall be carried out by an electrical contractor holding a valid license as required by the respective State Government. The contractor shall provide particulars of the license held by him or his subcontractor to the purchaser.

In accordance with the specific installation instructions or as directed by the purchaser, the contractor shall unload, erect, assemble, install, wire, test and commission all electrical equipment's Included In this contract. Equipment's shall be installed in a neat workman like manner with highest regard for safety.

Erection materials, tools, testing instruments or any other machinery of any nature shall not be supplied by the purchaser. Contractor shall arrange for the same in a timely manner and he shall not be allowed to claim for any delay or extra cost of any nature.

Consumable materials of any nature required for the erection job shall also have to be arranged by the contractor

Clearing the site after completion of erection as well as regular clearance of unwanted, materials from site, returning all packing material and excess material and excess material shall also be covered under the scope of work.

All equipment's and instruments of indoor and outdoor, shall be inscribed with number, nomenclature, danger boards and other instructions.

The contractor shall touch up the surface for all equipment's, which are scratched and / or damaged during transportation and erection. The paint used shall match exactly the surface being touched up.

The contractor shall employ skilled and semi-skilled laborers for erection, installation & testing as required. All electricians, cable jointers, wire men, welders and others employed shall be suitably qualified possessing valid certificates / licenses recognized by the competent authorities

The contractor shall also furnish a list of Engineers/Supervisors and staff employed by him for erection and installation jobs, giving in brief, qualification and experience of such staff and indicating whether they hold such competency certificates / licenses to supervise the electrical installation jobs as required under Indian Electricity Rules & State Electrical Inspectorate Rules.

The contractor shall set up his own workshop and other facilities at site to undertake fabrication jobs, pipe bending, threading etc.

The contractor shall be responsible for recording of all readings and observations during erection, testing and commissioning, in registers or on prescribed forms. These shall be carried in the presence of purchaser's representative. All such test data and records shall be duly signed by the contractor's Engineer / Purchaser's representative and shall be submitted to Purchaser in triplicate. The contractor shall carry out all tests at site for outdoor and indoor electrical equipment and commission the installation in the presence of Purchaser's representative. The contractor shall be responsible for final adjustment of relays, instruments, meters breakers etc., and also for submission of relay settings and calculations.

LIGHTING SYSTEMS

Three pin, 240V, 20A metal clad receptacle with switch shall be provided in the switchyard at locations to ensure accessibility with a 15M length of cable to any point in switchyard. The receptacle shall be mounted at 1.2 M above finished floor level.

All miscellaneous items not specifically mentioned but necessary for installation and completion of the lighting system are included in the scope of this contract.

6. TECHNICAL SPECIFICATION FOR TESTING AND COMMISSIONING

GENERAL

The testing and commissioning for all electrical equipment at site shall be according to the procedure laid down below.

All electrical equipment shall be installed, tested and commissioned in accordance with the latest relevant standards and codes of practices published by Indian Standards, institution wherever applicable and stipulations made in relevant general specifications.

The testing of all electrical equipment as well as the system as a whole shall be carried out to ensure that the equipment and its components are in satisfactory condition and will successfully perform in functional operation. The inspection of the equipment shall be carried out to ensure that all materials, workmanship and installation conform to the accepted design, engineering and construction standards, as well as accepted codes of practice and stipulations made in the relevant general specifications.

The contractor using his own instruments, testing equipment as well as qualified testing personnel shall carry out all tests.

The results of the tests shall be conform to the specification requirements as well as any specific performance data guaranteed during finalization of the contract.

GENERAL:

At the completion of the work, the entire installation shall be subject to the following tests in presence of Employer/Consultant.

1. Wiring Continuity Test
2. Insulation Resistance Test
3. Earth Continuity Test
4. Earth Resistivity Test

PREPARATION OF THE ELECTRICAL SYSTEM FOR COMMISSIONING

After completion of the installation at site and for the preparation of Electrical system commissioning, the contractor shall carry out check and testing of an equipment and installation in accordance with the agreed standards Codes of practice of Indian standards Institution and specific instructions furnished by the particular equipment suppliers

Checking required to be made on all equipment and installations at site shall comprise, but not be limited, to the following:

The following checks shall be made on all equipment and installation at site:

Physical inspection for removal of any foreign bodies, external defects, such as damaged insulators, loose connecting bolts, loose foundation bolts etc.

Check for grease, insulating / lubricating oil leakage and its proper quantity.

Check for the free movement of mechanism for the circuit breakers, rotating part of the rotating machines and devices.

Check for tightness of all - cable, bus bars at termination / joints ends as well as earth connections in the main earthing network

Check for Clearance of live bus bars and connectors from the metal enclosure..

Continuity checks in case of power cables

Check and calibrate devices requiring field adjustment! calibration like adjustment of relay settings etc., Check proper connection to earth network of all non-current carrying parts of the equipment and installation.

Test reports for all meters are to be furnished.

These tests shall be carried out on the equipment shall include but not be limited to the above

CABLES

1. Insulation resistance test with 2,500V megar for high voltage power cables rated above 1.1KV grade and 1000V megar for cables meted up to 1.1KV grade
2. All cables of 1.1KV cables shall be subjected to high voltage test after joining and terminating but before commissioning as per relevant standards.
3. In each test, the metallic sheath / screen / armour should be connected to earth.
4. Continuity of all the cores, correctness of all connections as per wiring diagram, correctness of polarity and phase of power cables and proper earth connection of cable glands, cable boxes, armour and metallic sheath, shall be checked.

EARTHING SYSTEM

Tests to ensure continuity of all earth connections.

Tests to obtain earth resistance of the complete network by using earth tester. The test values obtained shall be within the limits.

All documents / records regarding test data, oscillographs and other measured values of important ammeters finalized after site adjustment shall be handed over to the Owner in the form of test reports for their future use and reference.

III – TECHNICAL SPECIFICATION FOR AUDIO AND VIDEO SYSTEM WORKS

a). PROJECTOR:

XGA resolution (1280 X 800), projector method is front / rear/ ceiling mount, Driving method- Epson poly-silicon TFT active matrix, Pixel No. 1,024,000 dots X 3 (1280 X 800) LCDs Aspect ratio – 16 : 10 (Supports 4: 3 and 16 :9), Lamp type 205 W HUE. Through ratio range – 1.04 -1.26. Size of projector distance - 30” to 300”. Projector is compatible with PC & Mac computers. Contrast ratio is up to 2000:1 ratio. Projector lens is auto and manual type with the F number of .58 -1.7.focal length is 13.52 -16.2mm. Wireless remote control, two AA batteries, 6' AC Power Cord (Grounded, 3-Wire), 10' RGB Signal Cable, Operation Manual and CD-ROM. The Projector shall be UL approved and conform to FCC Class A. Projector additionally shall include a detachable 3-wire (grounded) AC Line Cord. Power supply is 100 -240 V +/- 10% Variation should works. 50/60 Hz AC. With card wires complete accessories all.

b). Ceiling mounted projector kit :

Spider bracket PSB-10, PSB -11 and PSB -20 fit, adjustable with 42.0 to 65.0cm (PSB – 10). 71.0 to 123.0 cm (PSB-20). Load capacity is 10 Kgs. Ivory white color is made up of Aluminum & metal

c). Projector Screen:

Maximum white 1.1 soft fabric Plus views Screen's wide selection of manual wall and ceiling screens gives the presenter a professional solution for any projection application or situation. All screens come with black masking borders as standard. Perfect Manual Wall or Ceiling Mounted projection Screen.

Matte White flame-retardant, mildew resist and fiberglass material.

Glass Beaded - This surface has the ability to achieve a higher gain by reflecting more of the projected image back along the projection axis. Glass beads impregnated into the screen's surface provide additional reflectance. This attribute creates an unparalleled screen surface that reproduces vibrant life-like color at moderate viewing angles. This unique front projection display panel is available in almost every size and aspect ratio and can be shaped and formed to any designer's needs. Matte White - The most versatile screen surface and the premier choice when ambient light is controllable. It evenly distributes light over a wide viewing area while colors remain bright and life-like, with no shifts in hue.

d). Ceiling Speaker:

Each speaker shall be provided with a means of adjusting (wherever mentioned) the output level over the rated speaker to an appropriate audio level in the area in which it is installed. This adjustment may be accomplished through the use of taps on the matching transformer. As a minimum, provide taps with ratings of 0.25, 0.5, 0.75 and 1 X Provide speakers as shown and as per design. Wall mounting permissible in areas with concrete or plaster ceiling. Each ceiling speakers back box shall be flush type and attached by suitable metal bars and/ or panels which shall span “T BAR” ceiling supports.

e). Audio power amplifier:

The power amplifier shall have a minimum of two inputs channels, each with bridge output circuitry and bridge or parallel single channel inputs. Each output shall be capable of providing a 7.7 v constant voltage audio line. Each output channel shall be selectable between eight ohms and 70.7 modes. The amplifier circuit components and load shall be fully protected from input overdrive, mismatching, or shorted failure. Input controls shall be lockable and fixed.

Frequency response - 45 to 15,000 Hz +/-1.0 Db. Minimum
Maxi hum and noise - 80 Db below rated output, minimum
Rated output - Minimum of 125 % consumed by associated Speakers.
Input for rated output - 0.8 V for rated output.
Total harmonic
Distortion - 0.5 5 Maximum rated output.
Output level - 25 and 70.7 options on the power amplifier.

f). 8 Channel automatic Intellix mixer

SCM810 8-Channel Automatic Mixer. Power cord is included! This eightchannel automatic mixer features the Shure patented IntelliMix®, which activates only microphones being addressed, minimizing poor audio caused by multiple open microphones. Features include adjustable EQ per channel, 48 V phantom power, active balanced microphone - or line-level inputs, line-level outputs, highly RF resistant chassis and circuitry, complete logic control of microphone activation, linking capacity for up to 400 microphones, with an internal power supply. 120/230 Vac power. Features Eight balanced mic-line input channels (Phoenix block connectors) One unbalanced 1/4" aux level input Eight unbalanced 1/4" direct line level outputs One balanced master line level output (Phoenix block connector) Selectable 46V phantom power per channel Level selectable peak output limiter Full rack width (single rack height)

g). Lapel micro phone system:

The microphone system with multi body material, inputs 1 X phone 1/4" (Microphone Jack), 1 X Barrel (power jack). Battery operated alkaline with AAA Voltage 1.5 Volts.

h). Wireless Boundary condenser microphone:

UHF Wireless micro phone boundary condenser type with the frequency response of 50 – 17000 Hz, Polar pattern(at 1khz,open circuit voltage) -33 Dbv /Pa(22 Cardoid,sensitivity (at 1 kHz. open circuit voltage)- 33 Dbv /Pa(22 mV)1 PASCAL=94 dB SPL,Dynamic range (1 k ohms) load at 1 kHz) 96 Db, common mode rejection(10 Hzto 100 kHz) 45 dB minimum preamplifier output clipping level(1% THD)- 6 dBV (0.5 V),Polarity positive sound pressure on diaphragm produces positive voltage on pin 2 relative to pin 3 of output XLR x connector or tip of 1/4 " phone plug, operating range 30m(100 ft),frequency stability +/- 10 ppm, frequency stability +/- ppm, maximum frequency deviation 45 kHz oscillator type phase locked loop(pll) controlled synthesizer, power requirements 3V (2AA alkaline or recharge batteries), Battery life .> 8 hours (alkaline),power consumption 130 mA, +/- 15 mA,operating temperature range 18 - 57 0c (0- 135 0F), dimension as per manufacturer specification and requirement with bespoke technology to avoid radio interferences like, wireless cell phone and PDA's etc., with frequency range 702 – 726 MHz.

l). Cable Cubby:

Cable cubby to be used for conferencing table, The cubby will be table top cable pull up box contain power socket 5 amps and 1 meters cable HDMI ,VGA, Audio, Cat5, Power and audio will be available this will be fixed properly without damaging the table corners and other area's.

2.0. Wireless receiver:

UHF Wireless Receiver with logic function. Audio output Level(Ref .+/- 38 khz deviation with kHz tone) XLR connector(into 600 Ohms load) 13 dbv,1/4 inch connector (in to 3000 ohms load) : -2 Dbv,output Impedance ,XLR connector :200 ohms1/4 inch connector : 1ohm,XLR output impedance balanced, sensitivity - 105 dBm for 12 dB SINAD,typical image rejection > 70 Db, typical, power requirements of 12 – 18 Vdc at 150 Ma, Supplied by external power supply, operating range under typical conditions 100m (300 ft). Audio frequency 45 Hz to 15000 Hz, frequency range 702- 726 MHz operations.

3.0. Wireless Boundary condenser microphone:

UHF Wireless micro phone boundary condenser type with the frequency response of 50 – 17000 Hz, Polar pattern(at 1khz,open circuit voltage) -33 Dbv /Pa(22 Cardoid,sensitivity (at 1 kHz. open circuit voltage)- 33 Dbv /Pa(22 mV)1 PASCAL=94 dB SPL,Dynamic range (1 k ohms) load at 1 kHz) 96 Db, common mode rejection(10 Hzto 100 kHz) 45 dB minimum preamplifier output clipping level(1% THD)- 6 dBV (0.5 V),Polarity positive sound pressure on diaphragm produces positive voltage on pin 2 relative to pin 3 of output XLR x connector or tip of 1/4 " phone plug, operating range 30m(100 ft),frequency stability +/- 10 ppm, frequency stability +/- ppm, maximum frequency deviation 45 kHz oscillator type phase locked loop(pll) controlled synthesizer, power requirements 3V (2AA alkaline or recharge batteries), Battery life .> 8 hours (alkaline),power consumption 130 mA, +/- 15 mA,operating temperature range 18 - 57 Oc (0- 135 OF), dimension as per manufacturer specification and requirement with bespoke technology to avoid radio interferences like, wireless cell phone and PDA's etc., with frequency range 702 – 726 MHz.

4.0. Ceiling Speaker:

Each speaker shall be provided with a means of adjusting (wherever mentioned) the output level over the rated speaker to an appropriate audio level in the area in which it is installed. This adjustment may be accomplished through the use of taps on the matching transformer. As a minimum, provide taps with ratings of 0.25,0.5,0.75 and 1 X Provide speakers as shown and as per design. Wall mounting permissible in areas with concrete or plaster ceiling. Each ceiling speakers back box shall be flush type and attached by suitable metal bars and/ or panels which shall span "T BAR" ceiling supports. The wide – Dispersion ceiling speaker enclosure bass reflex type rated input 6 watts (High Impedance), power handling capacity continuous pink noise: 6 W sound pressure level 90db (1w, 1m), frequency resonance 70Hz- 20 kHz (- 10Db), 50 Hz- 20 kHz (-20 db) at installation in ½ free sound field measured by installation the unit in the center of a ceiling).Speaker component 12 cm cone type, finish enclosure: steel plate, plating baffle : fire – resistance ABS resin material grade.

5.0. Automatic Mixer:

The mixer should have the 8 X 2 Digital matrix automatic mixer, 31 brand graphic equalizer.High pass and low pass filter, compressor, delay 0 - 40 ms, 32 scan memory, control input and output with rs 232 and D sub connector with 2 input of 3 Nos dual Microphone /Line input module with DSP, 2 input of 1 No Ambient Noise module /Telephone interface module, voice activated priority. The unit shall be 230 volts 50 Hz single phase and carded wire with necessary stand and provision of all.

TECHNICAL SPECIFICATIONS - AIR CONDITIONING WORKS

1.0.0 INTRODUCTION:

The SBI Life is proposed to be provided with air conditioning facilities. The following specifications highlight the technical requirements.

2.0.0 SERVICES TO BE PROVIDED BY THE PURCHASER:

The purchaser, through other agencies, will provide the following for the air conditioning:

1. All electrical cabling beyond this panel to the indoor / outdoor units shall be included by the bidder.
2. False ceiling works.

The bidder shall include all other works required for completion of the works.

3.00.0 GENERAL TECHNICAL REQUIREMENTS:

3.01.01 SCOPE OF WORK

The general scope of work to be carried out under this contract is illustrated in Drawings, Specifications and the schedule of quantities. Notwithstanding anything contained in this, the tenderer is to offer a proven and tested equipment to meet the requirements of this specification.

3.01.02 ASSOCIATED CIVIL WORKS

The purchaser will arrange to provide the following:

- a. False ceilings.

The air conditioning contractor shall provide all other works, including making openings in walls/floor for taking piping, ducting etc. The air conditioning contractor shall also supply and fix any wooden frames required for fixing the grills, diffusers, fire damper, fresh air intake etc required on the walls. All openings made for the above purposes shall be finished neatly with cement plastering etc.

3.01.03 BYE LAWS AND REGULATIONS

The installation shall be in conformity with the Bye Laws, Regulations and Standards of the local authorities concerned in so far as these become applicable to the installation.

If the Drawings or Specifications require something which violates the Bye Laws and Regulations, then the Bye Laws and Regulations shall govern the requirement of this installation.

3.01.04 WORKING PERMITS AND INSURANCE :

The Contractor shall obtain all work permits/ licences required for the personnel employed at the work site and shall strictly adhere to all the rules & regulations of the purchaser. All statutory rules like PF, minimum wages etc., are to be

followed strictly and registers as required by the law are to be maintained at site.

The contractor shall also fully cover the personnel employed and the materials used under comprehensive insurance, valid upto the duration of the contract plus 3 months.

3.01.05 DRAWINGS

The Contractor shall follow the tender drawings in preparation of his shop drawings and for subsequent installation work. He shall check the drawings of other agencies to verify spaces in which his work will be installed.

Maximum headroom and maintenance shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the purchaser before proceeding with the installation.

The Contractor shall examine all architectural, structural, plumbing, electrical and other services drawings before starting the work and report to the purchaser any discrepancies, coordinate installation of this work with other services and agencies.

3.01.06 TECHNICAL DATA

The tenderer must submit the technical data for all the items quoted quantity alongwith their tenders. Failure to furnish technical data with tender may result in rejection of tenders.

3.01.07 SHOP DRAWINGS

Within one week after the award of the contract, the contractor shall furnish, for the approval of the purchaser, two sets of detailed shop drawings of all equipment and materials including plant room layout, ducting, piping and control wiring layouts required to complete the project as per specification and as required by the purchaser. These drawings shall contain details of construction, size, and arrangement, operating clearance, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each item of equipment proposed shall be a standard catalog product of an established manufacturer as per specifications.

After final approval has been obtained from the purchaser, the contractor shall submit a further ten sets of shop drawings. No material or equipment shall be supplied for installation at the 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 materials, to allow the purchaser 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 programme.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimension. Where drawings are approved, said approval does not mean that drawings have been checked in detail nor does it in any way relieve the contractor of the responsibility or requirement to furnish material or perform work as required by the contract.

Where the work of the contractor has to be installed will interfere with work of other agencies, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the purchaser, the contractor shall prepare composite working drawings and sections at a suitable scale clearly showing how his work is to be installed in relation to the work of other agencies. If the contractor installs his work before coordinating with other trades, he shall make all the necessary changes without extra cost to the purchaser.

3.01.08 QUIET OPERATION AND VIBRATION ISOLATION

All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the purchaser. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, shall be considered objectionable. Such conditions shall be corrected by the contractor at his own expense. The maximum sound within 1M of the equipments shall not exceed 60 dB.

3.01.09 ACCESSIBILITY

The contractor shall verify the sufficiency of the size of the shafts and openings, clearance in cavity walls and piping. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The contractor shall locate all equipments which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed control damper, valve or other devices requiring attendance, shall be finalised and communicated in sufficient time, to be provided in the normal course of work, failing which the contractor shall make all the necessary repairs and changes at his own expenses.

3.01.10 ELECTRICAL INSTALLATION

It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the contract requirements, of the electrical installation work for air conditioning services, lies solely with the contractor.

All statutory approvals for electrical installation under the scope of this tender like CEIG / CEA approvals etc., shall be obtained out by the contractor. The required fees shall be paid by the purchaser but all other incidental expenses in connection with the inspection/ approval etc., shall be borne by the contractor.

3.01.11 MATERIALS AND EQUIPMENT

All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. General specifications for the various equipments / works are enclosed. Wherever these are not totally clarified, the construction shall be carried out as per the relevant IS specifications.

3.01.12 MANUFACTURER'S INSTRUCTION

Where manufacturers have furnished specific instructions, relating to the material and equipment used in this job, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

3.01.13 INSPECTION & TESTING

The purchaser's authorized representative shall have full powers to inspect any portion of the work, examine the materials, workmanship and getting the materials / equipments tested at the contractor's works or at any other place from where equipments/ materials are procured. These examinations will not relieve the contractor any of his responsibility for meeting the requirements of the specifications and it will be the contractor's responsibility to rectify/ replace such works/ equipments not found in accordance at his cost.

All the testing and measuring instruments and labour required shall be provided by the contractor at his cost. The contractor shall also calibrate the instruments used for testing at reputed calibration centers.

3.01.14 REJECTION OF DEFECTIVE PLANTS/EQUIPMENTS:

If the completed works or equipment or any portion there of taken over is found to be defective, or fail to fulfil any specification requirements, the contractor shall, on receipt of written notice, shall make good the defective works at his cost within a stipulated time frame. The purchaser shall have full powers to carry out such repair works at the risk and cost of the contractor, in case the contractor fails to carry out this within the stipulated time.

The purchaser shall have the right to operate the plant whether or not such equipments have been accepted.

3.01.15 BALANCING, TESTING AND COMMISSIONING

Balancing of all air and water systems and all tests as called for in the specifications shall be carried out by the contractor in accordance with the specifications and relevant local codes.

The results of these testing shall be submitted for scrutiny. Four copies of the certified manufacturer's performance readings for each piece of equipment shall be submitted alongwith the test results.

The Contractor shall arrange, all necessary balancing and testing equipment, instruments, materials, accessories and the requisite labour. Any defects in materials and / or in workmanship detected in the course of testing shall be rectified by the contractor entirely at his own cost, to the satisfaction of the purchaser. The installation shall be tested again after removal of defects and shall be commissioned only after approval of the purchaser. All tests shall be carried out in the presence of purchaser's representative.

3.01.16 COMPLETION DRAWINGS

On completion of the work in all respects, the contractor shall supply six (6) complete sets of drawings, on approved scale, indicating the work as installed.

These drawings shall clearly indicate the complete plant room layouts, ducting and piping layouts, location of all concealed piping, valves, controls, dampers, wiring and other services. The contractor shall also submit six (6) sets of consolidated control diagrams, technical literature of all equipment and materials. The contractor shall frame under glass in the AHU room, the respective duct layout drawings.

3.01.17 GUARANTEE AND DEFECTS LIABILITY PERIOD

The contractor shall guarantee that all equipments shall be free of any defects due to defective materials and bad workmanship and the equipment shall operate satisfactorily with the performance & efficiencies not less than the guaranteed values. The guarantee period shall be valid for a period of twelve (12) months after successful completion of the performance tests.

4.0.0 TECHNICAL SPECIFICATIONS:

4.1.0 DUCTING:

The ducting shall be of galvanized sheet steel with zinc coating as per class 8. Thickness of the sheet shall be as under:

Rectangular ducts upto 750mm	24 gauge
Rectangular duct 751 to 1250mm	22 gauge

ERECTION REQUIREMENTS:

- a. All ducts shall be fabricated and installed in workman like manner, generally conforming to the relevant ISI codes.
- b. Ducts shall be straight and smooth on the inside with neatly finished joints. Joints shall be made air tight.
- c. Changes in dimensions and shape of ducts shall be gradual. Curved elbows shall have a centre line radius equal to one and a half times the width of the duct. Air turns shall be installed with vanes, arranged to permit the air to make the turn without appreciable turbulence.
- d. 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 and breaking.
- e. All branch takeoffs and collars shall be provided with turning vanes.
- f. All necessary allowances and provisions shall be made by the contractor for beams, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes and or conduits, the ducts shall be

transformed, divided or curved to one side, the required area being maintained, all as per the site requirements.

- g. If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points in accordance with other services and as per approval of the Engineer.
- h. 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 MS rods of 8 to 10mm at every 2.5 meter centres and with 40 x 6mm angle only. All vertical duct work shall be supported by structural members at each floor level.
- i. The ducts shall not be supported from the underside of the steel girders at the ceiling slab level by means of suitable clamps. No weldings are permitted on the steel girder.
- j. All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibrations in the ducts, ducts shall be provided with flexible connections, located close to the unit. Unit connections shall be constructed of fire resistant flexible double canvas connection of atleast 150mm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

4.01.02 SUPPLY AND RETURN DIFFUSERS

The supply and return air diffusers shall be anodized aluminium construction, square or rectangular as per the drawings. Diffusers for different spaces shall be selected in consultation with the Engineer. Supply air diffusers shall be equipped with fixed air distribution grids, removable key operated volume control dampers of GI construction, and as required in specific applications.

Linear diffusers, if required as per the drawings, shall be anodized aluminium construction, one or two way blow linear diffusers. Supply air diffusers shall be provided with GI volume control balancing dampers within the supply air collar. Diffusers for different spaces shall be selected in consultation with the Engineer, and provided as per requirements of Schedule of Quantities.

The supply air collar will be made to project at least 15mm outside the vertical face of the false ceiling, and is to be trimmed flush with the false ceiling face, before fixing the grill. If this is not done, the purchaser reserve the right to reject the entire ducting system.

4.01.03 TESTING AND BALANCING

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leakages.

Before painting the interiors of conditioned space, 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. The entire air distribution system shall be balanced using an anemometer. Measured air quantities at

fan discharge and at various outlets shall be identical to the specified and quoted.

4.02.00 FIRE DAMPERS

- a. All supply air ducts at air handling unit room shall be provided with approved fire dampers of atleast 1.5 hours fire rating.
- b. Fire damper blades shall be one piece folded high strength galvanized steel construction. In normal position these blades shall be gathered and stacked at the frame head providing maximum air passage and preventing passing air currents from creating noise or chatter. The blades shall be held in position through a fusible link to close in case of fire. A potential free contact shall be provided in the fire panel of each floor by the fire alarm vendor. The AC contractor shall wire this to the AHU motor starter to trip the same in case of fire.
- c. Each fire damper shall be tested after installation to ensure closing on actuation of the connected fire alarm system.
- d. The fire damper frames shall be of 18 gauge GI and the blades of 22 gauge GI.

4.03.00 THERMAL INSULATION

- a. The tail end duct shall be insulated in the following manner.
- b. The insulation material for the chilled water piping shall be 25mm fibreglass material, laminated with Aluminium foil.
- c. The method of insulation is as under :
 1. Clean the surface to be insulated.
 2. Apply one coat of primer paint.
 3. Fix the insulation of the specified thickness over the surface of the duct tightly.
 4. Seal all the joints with 75mm wide PVC tapes.
 5. To prevent sagging of the insulation, provide nylon box strapping at every 1500 mm interval.

4.04.00 ACOUSTIC INSULATION:

The first 3 M of the ducting from the unit outlet shall be acoustically insulated in the following manner:

- 1 Fibreglass rigid board of 12 mm thick is to be secured on the in side of the duct through GI bolts, GI nuts and GI washers.
- 2 The insulation shall be covered with tissue paper.
- 3 Finally, 26 G perforated Aluminium sheet shall be provided over the tissue paper.

4.05.00 OUTDOOR UNITS:

1. The outdoor unit shall be of proven design and reputed make, consisting of hermetic scroll compressors, evaporator coil with fan and motor, drain pan, integral

copper refrigerant piping, safety controls and wiring, all mounted in a sheet steel powder coated enclosure.

2. The compressor shall be hermetically sealed scroll type, serviceable and shall have all safety cutouts and switches. The hermetic motor shall be suction gas cooled, sealed against dirt and moisture. The motor shall be suitable for 3 phase, 415 V, 50 Hz power supply.
3. The unit shall be modular type, constructed of minimum 16 G galvanized sheet, adequately reinforced with structural members, and provided with access panels for maintenance/ inspection of various components.
4. The refrigerant piping interconnecting the indoor unit and the outdoor unit shall be of suitably sized hard drawn copper piping, with brazed fittings. The valves shall be of brass or cast steel. Suitably sized filter drier with shut off valves shall be provided for maintenance. The controls shall comprise a thermostatic expansion valve, adequately sized. The refrigerant lines are to be pressure tested to 21 Kg/sq.cm.
5. Performance testing shall be carried out for each unit and the guaranteed capacity and power consumptions shall be achieved. The units shall operate without objectionable sound or vibrations, to the satisfaction of the owners.

4.06.00 HI WALL UNITS:

The Hi wall unit shall be of approved make, and shall have reciprocating or rotary compressor. The indoor unit shall have a pleasant appearance.

Each unit shall have an automatic timer to allow automatic tripping after 12 hours and automatic restart after the next 12 hours. The timer shall be of reputed make and suitable for Continuous use.

HVAC SYSTEM PROPOSED & DESCRIPTION

A Zonal air conditioning system shall be designed to provide year round thermal environmental control for all air-conditioned areas.

The VRV (Variable Refrigerant Volume) system consists of an outdoor unit with the compressors, Refrigerant Pipes and the different types of indoor units. The VRV plant can run at a capacity as low as 1 TR. VRV system offers saving in space, and running cost.

The indoor and the outdoor units are connected through the refrigerant pipes.

The fresh air intake for the Ceiling suspended units (CSU)/ Cassette units shall be through the Inline fans. Inline fans catering the fresh air to the CSUs and indoor units shall be placed in the area as per the drawing. The fresh air louvers on either side to be provided by other agencies.

Air distribution into conditioned space shall be through insulated galvanized sheet metal ducting and through ceiling mounted supply air diffusers/grilles. Each diffuser shall have an acoustically treated plenum connected to branch ducts by factory insulated flexible ducts. Kitchen shall be provided with mechanical ventilation system. The system shall consist of inline type fan, fresh air grille with filters, air distribution system with grilles, electrical panel,

power cabling, **control** wiring and earthing. Fresh air shall be drawn from outside and supplied by means of grilles.

VARIABLE REFRIGERANT VOLUME (VRV) SYSTEM BRIEF:

The VRV system comprises of outdoor condensing units, Indoor units, Refrigerant copper piping, Power and control cables and remote/centralized controller for operating the system. The indoor temperature sensor, according to the actual load of the indoor unit, controls the electronic expansion valve on the refrigerant medium pipe of the indoor unit. And it controls the compressor of the outdoor unit according to the change in the refrigerant medium pressure, varying the refrigerant volume of the system. In this way, the air conditioning system can adjust itself automatically to meet the needs of the change in the indoor load so as to attain the goal of conserving energy. The refrigerant piping of the variable refrigerant volume air conditioning system can be 100 – 150 meters long, and the height difference can be 50 meters. So there is a lot of flexibility to arrange the outdoor unit to avoid the conflict between the positioning of the outdoor unit and the architectural effect. The variable refrigerant volume air conditioning system has a high degree of intellectual control, with every indoor unit being able to directly start the air-conditioning system, freely setting and regulating the temperature, the volume and direction of the current, and the mode. Every indoor unit can separately control its start and close, and set and regulate its operations, so that it can meet the individual needs of the end-users. It is generally recognized that the variable refrigerant volume air conditioning system, because it is energy-efficient and easy to use, can be installed in residential buildings as well as medium and small- sized public buildings. As a matter of fact, this system has been installed in medium and small-sized office blocks, stores, restaurants and residential buildings, showing a growing trend. Excellent part load system performance delivering maximum comfort for minimal power consumption on the complete application temperature range. The diversity on the outdoor on the indoor installed units can be applied which reduces the power requirement.



The outdoor air cooled condensing units are easily located on the Terrace. Variety of indoor units like fan coil units, ductable ceiling suspended units, cassette units, high wall type units and floor mounted packaged units to suit the requirements at individual locations in a premise and to meet the special needs and also available in various capacities. Centralized control is also possible in addition to the individual remote control which is possible to be hooked to Building Management System.

Compared with the traditional central air-conditioning system, the most striking features of the variable refrigerant volume air conditioning system is easy to install, and flexible to operate. It can be installed, according to the availability of investment and the needs of decoration, by block, by section, by floor, by household, by phase and by batch. Operation of traditional central air-conditioning system is totally pre-designed by management side in accordance with time. It demands considerable high-energy consumption in low-loading operation, thus it cannot meet special needs of users. The variable refrigerant volume air conditioning system can make it true that each room is independently controlled. The output of outdoor machine can be automatically adjusted with the change of indoor working load, so the system can run with low cost round the hour as per user's actual needs. It is fit for use in holidays and in extra work shift.

2. SCOPE OF DESIGN

a.VRV (Variable Refrigerant Volume) system Design consisting of Outdoor units, Indoor Units and Refrigerant Piping.

Space allocation for Outdoor Units at Terrace Floor.

Space allocation of **ductable fan coil Units, highwall type units** for all the areas showing scheme drawing of all usable spaces like

Forced Ventilation system design for Toilets.

To maintain Indoor Air quality by appropriate Fresh air allocation.

ADVANTAGES OF SYSTEM CONTROLLER IN A VRV SYSTEM:

- d. Remote control with corded or cordless is possible
- e. System controllers can control multiple units – acts like mini BMS system
- f. Compatible for BMS system
- g. Individual controls & setting from remote control or system controller
- h. Group Timer setting
- i. Group fan speed controller
- j. Open protocol for BMS hooking

APPLICABLE STANDARDS:

Basically Air conditioning system design shall be done as per the latest ASHRAE standards. Also other applicable standards shall be considered as guidelines are mentioned as under:

- b.American Society of Heating Refrigeration Air conditioning Engineers (ASHRAE)
- c.Fresh air as per Green building standards
- d.IS wherever applicable
- e.SMACNA standards
- f.National Building Codes (NBC Codes)
- g.ECBC Standards
- h.NFPA 90 A installation of air conditioning and ventilation system
- i.AMCA standards

2.1 VRF TYPE:

Unit shall be a VRF system **inverter driven heat pump air conditioner / Digital scroll with vapour** injection technology for application with R410 A refrigerant air cooled, variable refrigerant flow air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor unit shall have suitable capacity to cool independently for the requirement of the respective spaces.

It shall be possible to connect multiple indoor units on respective refrigerant circuits as shown in the drawings/BOQ. The indoor units can be of different type and also controlled individually. Following type of indoor units is envisaged to be connected to the system:

- Ceiling mounted cassette type (2 and 4 Way flow).
- Wall mounted Hi-Wall type.
- Slim Ceiling mounted ductable type.

Compressor installed in outdoor unit shall be equipped with inverter controller, and capable of changing the rotating speed to follow variations in cooling. Outdoor unit shall be suitable for mix-match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor units shall be extended up to 150m with maximum 50 m level difference. Oil recovery system shall be designed to operate without disturbance to normal operation cycle of the system / compressor.

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

2.2 OUT DOOR UNIT:

The outdoor unit shall be factory assembled, weather proof casing constructed from heavy gauge galvanized steel sheet with powder coated finish.

All outdoor units above 12 HP rating shall have minimum three numbers scroll compressors out of which one compressor shall be Variable based.

Each refrigeration cycle shall be equipped with screw, solenoid valve, heat exchanger, an accumulator, 4-way valve and flare connection parts

In case of outdoor units with multiple compressors, the operation shall not be disrupted with failure of any compressor.

The noise level shall not be more than 60 dB (A) at normal operation measured horizontally 1m away and 1.5 m above ground level.

The unit shall be provided with microprocessor control panel.

The outdoor fans shall be plastic propeller type, dynamically balanced. The fan shall be directly driven by a suitable motor for vertical flow discharge. The fan motor shall be permanently lubricated and be protected from ingress of water.

The compressor shall be protected against breakdown by a quick response over current relay, a high pressure switch, a wraparound type oil heater and discharge gas thermistor.

2.3 LOW NOISE MODE AT NIGHT:

The outdoor unit of variable refrigerant flow system has a peculiar function of night shift setting, which reduces the noise level by 5 Db at night when operating at full capacity compared with the normal operation in daytime.

2.4 COMPRESSOR:

The compressor shall be high efficiency screw and capable for capacity controlling. It shall change the speed / refrigerant mass flow rate in accordance to the variation in cooling load requirement.

The inverter compressor used should be DC inverter only and shall be IGBT (insulated gate bipolar transistor) type for efficient and quiet operation.

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

2.5 OUTDOOR HEAT EXCHANGER:

The Heat Exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fan coil and larger surface area.

The fins shall have anticorrosion treatment for Heat Exchanger Coil. The treatment shall be suitable for areas of high pollution, moisture and salt laden air.

The casings, fans, motors etc. shall also be with anticorrosion treatment as a standard features.

The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical / horizontal discharge and shall be capable of handling minimum 6 mm external pressure drop. Each fan shall have a safety guard.

2.6 REFRIGERANT CIRCUIT:

The Refrigerant Circuit shall include a liquid receiver /accumulator, liquid & gas shut off valves and a solenoid valve. All necessary safety devices shall be provided to ensure the safety operation of the system.

2.7 SAFETY DEVICES:

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

Following safety devices shall be part of the outdoor unit high pressure switch, low pressure switch, fuse, crankcase heater, fusible plug, over current protection for inverter, and short recycling guard timer.

2.8 PIPING:

All connections of Refrigerant piping shall be in high grade Copper of Refrigeration quality and material test Certificates.

All connections, tees, reducers etc. shall be standard make fittings.

Insulation of cold lines shall be carried out with Armaflex / K-Flex / finolex equiv. insulation sheets and tubes of appropriate thickness so that condensation does not occur.

For individual Piping 50 / 100 mm wide Aluminium Tape shall be used at joints of Piping with Bands for identification.

2.9 OIL RECOVERY SYSTEM:

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

System shall be designed for proper oil return to compressor along with the distribution of oil to individual compressor.

The refrigerant piping shall be extended upped 150 Mtr with 50 Mtr level differences.

2.10 INDOOR UNITS:

Units shall be factory assembled, wired, piped and tested.

Units shall have DX coils with copper tubes and bonded copper fins for highly efficient heat transfer.

Units shall have Centrifugal fans for adequate amount of Air circulation and low Noise.

Units shall have inlet filters, which are easily cleanable and replaceable.

All components of Units are easily accessible for connection, repairs and maintenance.

Units shall have very low noise.

All units with Factory manufactured Units, Grills shall have auto swing feature for proper Air distribution.

All units shall be controlled by electronic Expansion Valves only.

All units mounted inside the ceiling shall have fans capable of sustaining duct connections, and special filters if necessary.

All units shall have adequate insulation or Lining to avoid condensation.

2.11 CEILING MOUNTED CASSETTE TYPE UNIT (4 way 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 possible to suspend from four corners.

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

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

All cassette type indoor units shall have three speed fan motors.

2.12 CEILING MOUNTED DUCTABLE TYPE UNIT:

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

All ductable type indoor units below 8 HP shall have three speed fan motors

2.13 CENTRAL REMOTE CONTROLLER:

A multi-functional centralized controller (central remote controller) shall be supplied as an optional accessory.

The controller shall be able to control outdoor units and indoor units.

- Temperature setting for each zone, or group, or indoor unit.
- On/Off as a zone or individual unit.
- Indication of operating condition.
- Select ON of all operation modes for each zone.
- The controller shall have wide screen liquid crystal display (LCD) and shall be wired by a non polar 2 wire transmission cable to a distance of 1000m away from the indoor unit.

2.14 CONDENSATE:

1" dia PVC pipes & fittings shall be used from condensate from Evaporator Unit to drain point. The joints shall be properly sealed so that there is no water leakage. U-trap as required shall be provided at the end. Additional insulation drain tray shall be provided below the Evaporator Unit, if required.

2.15 MOUNTING:

All indoor units shall be mounted with Brackets, Hangers etc. with proper size anchor Fasteners.

3.0 FRESH AIR INTAKES:

Extruded aluminium construction duly anodized (20 microns and above) fresh air louvers with bird screen and dampers shall be provided in the clear openings in masonry walls of the air handling unit rooms having at least one external wall. Louvers, damper, pre-filters, ducts and fresh air fan with speed regulator shall be provided as shown on Drawings and in Schedule of Quantities. Fresh air dampers shall be of the interlocking, opposed-blade louver type. Blades shall be made of extruded aluminium construction and shall be rattle-free. Dampers shall be similar to those specified in "Air Distribution". Fresh air fans and fresh air intakes shall be as per the requirements of Schedule of Quantities.

3.1 PAINTING

Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

3.2 TESTING

Cooling capacity of various air handling unit models be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Flow measurements shall be by an anemometer and temperature measurements by accurately calibrated mercury-in-glass thermometers. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

DUCTABLE SPLIT TYPE DX UNITS

1.1 Cabinet

The shell shall be constructed out of corrosion resistance epoxy coated GI sheets of 18 SWG thick and the back panel can be made out of 20 SWG CR epoxy coated sheet metal. All panels should be of easily removable type for maintenance. Coil and blower section shall be internally lined with 12 mm thick resin bonded fiberglass and covered with nylon netting OR suitable similar material.

1.2 Evaporator Coil

The cooling coil shall be made out of 9.5 mm OD Copper tubes with external mechanically bonded Aluminum fins, with a fin spacing of not less than 5 fins/cm. The cooling coil shall have sufficient face area, so that the face velocity shall not exceed 165 m/min. A corrosion resistant drain pan shall be provided beneath the cooling coil, along with an outlet nozzle of not less than 40 mm dia. for drain connection. Washable type synthetic fabric media pre-filters of filtration efficiency of 90 % down to 20 microns shall be provided ahead of the cooling coil. The filter shall be easily removable for cleaning purposes.

1.3 Evaporator Fan

The evaporator fan shall be of Centrifugal type with DIDW impeller. The fan and the drive shaft shall be statically and dynamically balanced. The fan shall be either directly driven OR belt driven by a suitably rated TEFC squirrel cage motor rated for 415 V, 3 phase, 50 Hz power supply. The motor shall be factory wired and brought out to a terminal block mounted on the outside of the unit, to facilitate easy wiring at site. The fan shall be quiet in operation and the noise level should not exceed 60 dBA.

1.4 Compressor

Compressors offered shall be of Hermetic scroll type, suitable for operating with R-104 / R-134a refrigerant. The motor shall be rated for 415 V, 3 phase, 50 Hz power supply and should be capable of operating under +/- 10 % fluctuations in the supply voltage. If multiple compressors are offered for the specified split units, then each of the compressors shall be of equal capacity. Moreover, an electronic temperature controller shall be provided which shall automatically and progressively trip the compressors under partial load conditions. The compressors shall be housed in the in the air cooled condensing unit.

1.5 Air Cooled Condensing Unit

The condensing unit shall be designed for out door installation and hence be of weather proof construction. This shall house the Compressor(s) and the air cooled condenser. The condenser coil shall be with 9.5 mm OD Copper tubes and minimum 26 SWG mechanically bonded aluminum fins, with a fin spacing of not less than 5 fins/cm. The coil should be adequately sized to handle the the design heat rejection and also provide sub cooling. The coil should be designed to work under a peak ambient temperature of 41 Deg C. The air cooled condenser fan shall ideally be propeller type and should be selected for low speed and quite operation. The noise level should not exceed 75 dBA.

1.6 Refrigerant System & Controls

The refrigerant piping interconnecting the indoor and outdoor units shall, preferably hard drawn copper tubes and with brazed joints. The system shall be complete with all necessary controls & fixtures like, shut off valves, strainers, thermostatic expansion valves, HP/LP safety cut outs etc.. Solid state temperature sensors for setting and controlling the temperature shall be provided.

1.7 Electrical

The units shall be supplied with a control panel, which shall house the complete electrical switch gear. For ductable split units, the panel shall be remotely located in an accessible location close to the indoor unit. For package units, the panel shall be housed in the unit itself. All necessary contactors, over load relays, anti-recycle timer relays etc.. Shall be housed within this panel. Main power supply, if not specified otherwise in the BOQ or elsewhere, shall be terminated by the client in this panel and feeder cables to feed power to the out door condensing units shall be carried out by the AC contractor only.

1.8 Control Panel

The ductable split units shall be supplied with micro-processor based control system. The system shall have digital display of the return air temperature and the set point temperature.

The following safety features shall be provided and the same shall have LED indications:

- Under voltage / over voltage trip.
- Phase Failure / Phase reversal trip.
- High Pressure trip (comp1 & comp2 for dual circuits)
- Compressor O/L trip (comp1 & comp2 for dual circuits)
- Fan fails indication.

The following mode selection shall be provided:

- Fan Mode,
- Cool Mode.

The panel shall allow temperature set point adjustment.

REFRIGERANT PIPING

1.1 General: The scope of this section covers supply, laying, testing and commissioning of copper refrigerant piping. The tender drawings enclosed depict the schematic layout for

the refrigerant piping routing. The contractor shall prepare his working drawings for approval by the consultant before execution at site.

- 1.2 Hard drawn copper pipes shall be used for the refrigerant piping.
- 1.3 Refrigerant pipe sizes indicated in the tender is only tentative and the contractor shall confirm the same.
- 1.4 Refrigerant piping shall be designed as per the requirement of the system. Suction risers shall be designed as per the minimum load requirement of the system. The contractor shall submit the design calculations for the same for the consultant's approval and then execute the same at site.

1.5 Testing:

- a. Pipes after full brazing / soldering are completed shall be pressure tested, without giving connections to the equipment. Pipes could be tested in sections and after testing the ends should be capped. No insulation or painting for the pipes shall be carried out before the pressure testing is completed and approved by their Engineer in-charge.
- b. All pipes shall be tested for pressure as under:
 - i) **600 psig for the piping system.**

In all the above cases the system should hold the pressure for 24 hours without any drop. The pressure testing and pressure reading should be inspected and approved by the Engineer in-charge. Any defects or leakage found during pressure testing shall be rectified and tests re-conducted.

- c. The Contractor shall organize arrangements for pressure testing.
- d. Since hermetic / semi-hermetic compressors are proposed to be used, pressure testing should be carried out with dry Nitrogen gas. After pressure testing is completed successfully, the gas shall be vented, the system vacuumed, tested for vacuum test and then charged with refrigerant gas.

1.6 Measurements:

The pipes, for payment purposes, shall be measured as under:

The pipe lengths specified in the BOQ shall be deemed to be inclusive of all fittings like Bends, Elbows, Reducers, Pipe supports, clamps etc. These will not be measured separately and paid for. The pipes shall be in unit length rounded off to the nearest centimeter and measured along the centre line of the pipe and fittings. The rates quoted shall also be inclusive of necessary painting as specified.

Condensate, drain piping and Refrigerant piping insulation:

(Vidoflex / equivalent – 13mm thickness) – closed cell electro-metric Nitrile rubber with conductivity rating of $K = 0.035W (m.k)$ at 0 deg C, condensation control, fire resistance. Flame and smoke proof. Density = 4.6pound /cu.ft (0.06 gm/ cm³). The application method shall prevent the ingress of moisture through the insulation to the cold surface.

Insulation shall fit closely to the pipe work and other surfaces without gaps between joint. Each

section of preformed insulation shall be secured to the pipe by means of circumferential bands of non-corrodible metal, plastics, fabric or glass fibre reinforced tape set in site-applied adhesive. Flexible closed – cell insulation shall be sleeve mounted on piping or shall be split, snap fitted and all joints secured with adhesive recommended by the insulation manufacturer.

At all points of support, the insulation, outer covering and vapour seal, shall not be pierced or fouled by the supports. The insulation at supports shall be material of sufficient compressive strength to carry the loads transmitted to the supports. The load-bearing insulation shall be extended on each side of such locations.

TEST READINGS

The following minimum readings shall be taken after commissioning and balancing of the complete Air Conditioning System. From the test readings the equipment capacities shall be computed and the quoted capacities should be established. Any discrepancies found out should be rectified free of cost. The Air conditioning Plant will be taken over by the Owner only after successful completion of the above.

Compressor:

Suction Pressure - Kg / sq.cm. :

Suction Temperature - deg C :

Discharge Pressure - Kg / sq.cm:

Condensing Temperature - deg C :

Voltage - volts:

Computed compressor capacity based on the above operating parameters and compressor rating charts:

II. Air- Cooled Condenser:

Entering air temperature - deg C:

Leaving air temperature - deg C:

Air flow as measured through condenser coil: LPM

Calculated condenser heat rejection from the above

Kcal / hour:

III. Evaporator Coil:

Entering air dry bulb temperature - deg C:

Entering air wet bulb temperature - deg C:

Leaving air dry bulb temperature - deg C:

Leaving air wet bulb temperature - deg C:

Air flow rate across cooling coil - CMH:

Calculated coil capacity Kcal / hour:

Fresh air flow rate - CMH:

Fan motor current - Amps:

Power consumed by fan motor - KW:

V. Inside Conditions:

Dry bulb and RH readings at every 10 sqmtrs
Conditioned area shall be recorded and tabulated.
This shall be carried out using digital temp. &
Humidity measuring instruments. :

1.0 PERFORMANCE DATA

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

1.1 TESTING

Capacity of all fans shall be measured by an anemometer. Measured air flow capacities shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

1.2 DRAIN PIPING

- a. All pipes to be used for condensate drain and fittings shall be Blue HDPE Pipe.
- b. All jointing in the pipe system shall be by Fusion joints by fusion welding machine.
- c. All pipes supports shall be mild steel, thoroughly cleaned and given one primary coat of red oxide paint before being installed.
- d. All equipment and valve connections, or connections to any other mating pipes shall be through flanges required for the mating connections. Fittings & flanges shall form part of piping and are not separately identified in Schedule of Quantities.
- e. Gate valves shall be similar to those specified for condensing piping.
- f. For proper drainage of AHU-C Condensate, 'U' trap shall be provided in the drain piping.
- g. All condensate drain piping shall be insulated and painted as per the section "Insulation" as indicated in Schedule of Quantities.

1.3 REFRIGERANT PIPING

- a. All refrigerant pipes and fittings shall be hard drawn copper tubes and wrought copper / brass fittings suitable for connection with silver solder / phos-copper.
- b. All joints in copper piping shall be sweat 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 be thoroughly blown out using carbon-dioxide / nitrogen.
- c. Refrigerant lines shall be sized to limit pressure drop between the evaporator and condensing unit to less than 0.2 kg per sq.cm.
- d. Sight glass with moisture indicator and removable type combination dryer cum filter with MS housing and brass wire mesh / punched brass sheet shall be installed in liquid line of the refrigeration system incorporating a three valve by pass. After ninety days of operation, liquid line drier cartridges shall be replaced.
- e. Heat exchanger shall be MS heavy duty pipe in pipe type and without any joint in the inner pipe.
- f. Horizontal suction line shall be pitched towards the compressor and no reducers shall be provided for proper oil return.
- g. After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using Freon mixed with nitrogen / carbon-dioxide at a pressure of 20 kg per sq. cm (high side) and 10 kg per sq. cm (low side). Pressure shall be maintained in the system for a minimum of 12 hours. The system shall then be evacuated to a minimum vacuum of 70 cm of mercury and held for 24 hours. Vacuum shall be checked with a vacuum gage.
- h. All refrigeration piping shall be installed strictly as per the instructions and recommendations of air conditioning equipment manufacturer.

2 PIPING INSTALLATION

- a. Design Drawings indicate schematically the size and location of pipes. The Contractor, on award of the work, shall prepare detailed shop drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and Refnet Joints and all pipe supports. He must keep in view the specific openings in the building through which pipes are designed to pass.
- b. Piping shall be properly supported on, or suspended from, stands, clamps, and hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency.
- c. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated black. Where pipe and clamps are of dissimilar materials, a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following :

Pipe size	Spacing between supports	Rod Size
Upto 12 mm	1.5 Meter	10 mm
15 to 25 mm	2.0 meter	10 mm
30 to 150 mm	2.0 meter	10 mm
Over 150 mm	2.5 meter	12.5 mm

- d. Vertical pipes passing through floors shall be plumb and parallel to wall. Pipes shall be supported on alternate floor. MS cleats shall be welded on pipes and rest on MS channel placed on the floor with 15 mm thick resistoflex pads between the cleat and channel. U clamps with resistoflex sheet shall be provided to keep the pipe in position.
- e. Bull heading in water/refrigerant piping shall be avoided.
- f. Pipe sleeves at least 3 mm thick, 50 mm / 100 mm larger in diameter than condenser / chilled water pipes respectively shall be provided wherever pipes pass through retaining wall and slab. Annular space shall be filled with fiberglass and finished with retainer rings welded on the ends of the sleeve.
- g. Wherever pipes pass through the brick or masonry / slab openings, the gaps shall be sealed with **fire sealant** such as fire barrier caulks.
- h. Insulated piping shall be supported in such a manner as not to put under pressure on the insulation. 20 gauge metal sheets shall be provided between the insulation and the clamp, saddle or roller, extending at least 15 cm on both sides of the clamp, saddles or roller.
- j. All piping work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings and structure. The entire piping work shall be organized, in consultation with other agencies work, so that laying of pipes, supports, and pressure testing for each area shall be carried out in one stretch.
- k. Cut-outs in the floor slabs for installing the various pipes are indicated in the Drawings. Contractor shall carefully examine the cut-outs provided and clearly point out where the cut-outs shown in the Drawings do not meet with the requirements.
- l. The Contractor shall make sure that the clamps, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

- m. All pipes shall be accurately cut to the required size in accordance with relevant BIS Codes, edges beveled and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.
- n. Flanged inspection pieces 1.5 meters long, with bolted flanges on both ends, shall be provided no more than 30 meters centers, or where-ever shown in Approved-for-Construction shop drawings, to facilitate future cleaning of all welded pipes.
- o. All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters and wrapped with three layers of fiber glass tissue, each layer laid in bitumen.
- p. Insulated buried pipes shall be cleaned, de-rusted, then coated with rust-resistant primer and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters. Insulation shall be applied as per the section "Insulation", wrapped with GI wire and covered with polyethylene sheet. Two coats (each 6 mm thick) of cement plaster shall be applied over chicken wire mesh lath. Where indicated in Schedule of Quantities, buried insulated pipes shall be water-proofed using coat of Shalibond, or approved adhesive, over the plastered surface; wrapping one layer of fiber glass RP tissue and one layer of roofing tar felt with sufficient overlaps, set and sealed with the adhesive, held in position by 16 gage G.I wire tied at 15 cm intervals.

3.0 AIR DISTRIBUTION

3.1 SCOPE

The scope of this section comprises supply fabrication installation and testing of all sheet metal / aluminium ducts, supply installation testing and balancing of all grilles registers and diffusers, in accordance with these specifications and the general arrangement shown on the Drawings.

3.2 DUCT MATERIALS

All ducts shall be fabricated from galvanized steel sheets / aluminium sheets of the following thickness as indicated in Schedule of Quantities.

	G S S	ALUMINIUM
Rectangular ducts up to 75 cm	24 gauge	22 gauge

Sheet metal ducts shall be fabricated out of galvanized steel sheets. Fabrication of ducts shall be through well conditioned Triplex lock former or multiple lock formers, conforming to relevant BIS00000 Codes. Sheets used shall be produced by Hot Dip Process and galvanizing shall be Class VII - Light Coating of zinc, Nominal 180 gm /Sq m surface area.

Samples of sheet from each lot selected at random by Owner's site representative shall be subject to approval & gotten tested for thickness and zinc coating at contractor's expenses.

- 3.3 All ducts shall be fabricated and installed in workmanlike manner, generally conforming to relevant BIS Codes. Round exposed ducts shall be die-formed for achieving perfect circle configuration.
- 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.
 - b. Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.
 - c. All exposed ducts up to 60 cm width within conditioned spaces shall have slip joints - or flanged joints. The internal ends of slip joints shall be in the direction of air flow. 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. 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 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 gage GSS / 16 gauge aluminium, thoroughly stiffened with 25 mm x 25 mm x 3 mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Doors shall be not less than 45 cm x 45 cm in size.
 - g. Plenums shall be panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards G S sheet and riveting shall be done from outside.
 - h. Self adhesive rubber lining minimum 5 mm thick instead of felt shall be used between duct flanges and between duct and duct supports *in* all ducting installation.
- 3.4 All ducts shall be installed generally as per tender Drawings, and in strict accordance with approved shop drawings to be prepared by the Contractor.
- 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 Owner'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 Owner's site representative.
- 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 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. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized 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. 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. Hanger rods shall then hang through the cleats.
- e. Ducting over furred ceiling shall be supported from the slab above, or from beams, after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other Contractor's work in the building.
- g. 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 fire sealant such as fire barrier mortar for complete sealing.***
- h. 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 flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 10 cm 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.
- j. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

3.5 DAMPERS

- a. Dampers: All duct dampers shall be opposed blade louver dampers of robust 16 G GSS construction and tight fitting. The design, method of handling and control shall be suitable for the location and service required.
- b. Dampers shall be provided with suitable links levers and quadrants as required for their proper operation. Control or setting device shall be made robust, easily operable and accessible through suitable access door in the duct. Every

damper shall have an indicating device clearly showing the damper position at all times.

- c. Dampers shall be placed in ducts at every branch supply or return air duct connection, whether or not indicated on the Drawings, for the proper volume control and balancing of the air distribution system.

3.6 SUPPLY AND RETURN AIR REGISTERS

Supply & return air registers shall be of either steel or aluminium sections as specified in schedule of quantities. Steel construction registers shall have primer Coat finish whereas extruded aluminium registers shall be either Anodized or Powder Coated as specified in Schedule of Quantities. These registers shall have individually adjustable louvers both horizontal and vertical. Supply air registers shall be provided with key operated opposed blade extruded aluminium volume control damper anodized in matt black shade.

The registers shall be suitable for fixing arrangement having concealed screws as approved by Architect. Linear continuous supply cum return air register shall be extruded aluminium construction with fixed horizontal bars at 15 Deg. inclination & flange on both sides only (none on top & bottom). The thickness of the fixed bar louvers shall be minimum 5.5 mm in front and 3.8 mm in rear with rounded edges. Flanges on the two sides shall be 20 mm/30 mm wide as approved by Architect. The grilles shall be suitable for concealed fixing. Volume control dampers of extruded aluminium anodized in black colour shall be provided in supply air duct collars. For fan coil units horizontal fixed bar grilles as described above shall be provided with flanges on four sides, and the core shall be & suitable for clip fixing, permitting its removal without disturbing the flanges.

- a. All registers shall be selected in consultation with the Architect. Different spaces shall require horizontal or vertical face bars, and different width of margin frames. These shall be procured only after obtaining written approval from Architect for each type of register.
- b. All registers shall have a soft continuous rubber/foam gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers for air flow shall not be less than 66 percent of gross face area.
- c. Registers specified with individually adjustable bars shall have adjustable pattern as each grille bar shall be pivotable to provide pattern with 0 to +45 degree horizontal arc and up to 30 degree deflection downwards. Bars shall hold deflection settings under all conditions of velocity and pressure.
- d. Bar longer than 45 cm shall be reinforced by set-back vertical members of approved thickness.
- e. All volume control dampers shall be anodized aluminium in mat black shade.

3.7 SUPPLY AND RETURN AIR DIFFUSERS

Supply and return air diffusers shall be as shown on the Drawings and indicated in Schedule of Quantities. Mild steel diffusers/dampers shall be factory coated with rust-resistant primer. Aluminium diffusers shall be powder coated & made from extruded aluminium section as specified in schedule of quantities.

- a. Rectangular Diffusers shall be steel / extruded aluminium construction, square & rectangular diffusers with flush fixed pattern for different spaces as per schedule of quantities. These shall be selected in consultation with the Architect. These shall be procured only after obtaining written approval from Architect for each type of diffuser.
- b. Supply air diffusers shall be equipped with fixed air distribution grids, removable key-operated volume control dampers, and anti-smudge rings as required in specific applications, and as per requirements of schedule of quantities. All extruded aluminium diffusers shall be provided with removable central core and concealed key operation for volume control damper.
- c. Linear Diffuser shall be extruded aluminium construction with removable core, one or two way blow type. Supply air diffusers shall be provided with volume control/ balancing dampers within the supply air collar. Diffusers for different spaces shall be selected in consultation with the Architect, and provided as per requirements of schedule of quantities. All diffusers shall have volume control dampers of extruded aluminium construction anodised in mat black shade.
- d. Slot Diffuser shall be extruded aluminium construction multi slot type with air pattern controller provided in each slot. Supply air diffusers shall be provided with Hit & Miss volume control dampers in each slot of the supply air diffusers. Diffusers for different spaces shall be selected in consultation with the Architect and provided as per requirement of Schedule of Quantities.

3.8 MEASUREMENTS FOR DUCTING

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centre-line measurements described herewith :

- a. Duct Work shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centre line distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 3 mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories

required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for.

- b. Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:
 - i. Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.
 - ii. Diffusers - cross section area for air flow at discharge area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.
 - iii. Linear diffusers - shall be measured by cross-sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.
 - iv. Fire dampers - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.
 - v. Flexible connection - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.
 - vi. Kitchen Hoods - shall be measured by their cross sectional area at the capture point of fumes, parallel to the surface of kitchen equipment. Quoted rates shall include the grease filters, provision for hood light, suspension arrangement for the hood, profile to direct the air to ventilation ducts and provision for removable drip tray.

3.9 TESTING AND BALANCING

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by visual inspection.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

4.0 INSULATION

4.1 SCOPE

The scope of this section comprises the supply and application of insulation conforming to these specifications.

4.2 MATERIAL

Insulation material for Duct & Pipe insulation shall be Cross linked polyethylene insulation having a low & stable 'K' value of 0.027 – 0.029 k.cal/hr.m deg C (at 0 deg C to 23 deg C) with bulk density of 28+/- 4 kg/cum, Fire retardant in self extinguishing non-dripping fire rating class – 1 as per BS: 467 part 7, negligible water vapour permeability having good zone resistance, non fiber erosion and should be CFC free

Thickness of the insulation shall be as specified for the individual application. **Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values, density, water vapour permeability and fire properties.** Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost. Adhesive used for sealing the insulation shall be non-flammable, vapour proof adhesive strictly as per manufacturer's recommendations.

4.3 DUCT ACOUSTIC LINING

Ducts so identified and marked on drawings and included in Schedule of Quantities shall be provided with acoustic lining of thermal insulation material for a distance of minimum 5 meters as follows:

The inside surface for the ducts shall be covered with adhesive, and provided with 26 gauge GI Channels 25 x 25 mm screwed back to back and fixed on the inside of duct, spaced not more than 60 cm center to center to form a frame work of 60 x 60 cms square. Cut panels 60 x 60 cms of resin bonded fiber glass 25 mm thick, density of 32+/- 4 kg/cum shall be fitted in the squares.

These insulation panels shall be fixed to the sheet metal with cold setting adhesive compound. The inner most surfaces shall be covered with fiberglass tissue and 28 gauge perforated aluminium sheet having at least 15 percent perforations. The aluminium sheet shall be screwed to GI channels using cup washer and neatly finished to give true inside surface.

4.4 DUCT INSULATION

External thermal insulation shall be provided as follows :

Chemically crossed linked closed cell FR-XPE plain polyethylene insulation grade for supply air having a low & stable 'K' value of 0.027 – 0.029 k.cal/hr.m.deg C (at 0 deg c to 23 deg C) with minimum density of 28+/- 4 kg/cum, fire retardant in self extinguishing non –dripping. Fire rating class – 1 negligible water vapour permeability having good zone resistance, non – fiber erosion and should be CFC free.

The thickness of insulation shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubber sheets to size with sufficient allowance in dimension.

Material shall be fitted under compression and no stretching of material shall be permitted. Apply thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All longitudinal and transverse joints shall be sealed by providing 6 mm thick 50 mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer.

4.5 PIPING INSULATION

All refrigerant and condensate drain piping shall be insulated with cross linked polyethylene insulation in the manner specified herein. Cross linked polyethylene insulation having a low & stable 'K' value of 0.027 – 0.029 k.cal/hr.m deg C (at 0 deg C to 23 deg C) with bulk density of 28+/- 4 kg/cum, Fire retardant in self extinguishing non-dripping fire rating class – 1 as per BS: 467 part 7, negligible water vapour permeability having good zone resistance, non fiber erosion and should be CFC free. Before applying insulation, all pipes shall be brushed and cleaned. For copper pipes insulation shall be applied as follows or as specified in drawings or schedule of quantity:

Pipe size (mm)	Thickness of Cross-linked polyethylene foam insulation
6.4 OD to 12.7 OD Refrigerants pipes	9 mm
Above 15.9 OD Refrigerants pipes	13 mm
25 mm to 50 mm Condensate drain pipes	13 mm

Insulating material in tube form shall be sleeved on the pipes. On piping, slit opened tube from insulating material shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre. Wherever flat sheets shall be used it shall be cut out in correct dimension using correct tools. Scissors or Hacksaw-blade shall not be allowed. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. All longitudinal and transverse joints shall be sealed by providing 6 mm thick, 50 mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer. The insulation shall be continuous over the entire run of piping and Ref net.

Manufacturer's installation manual shall be submitted and followed for full compliance. All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (S.R. or R.R.) and provided with 150 mm wide band of paint along circumference at every 1200 mm for colour coding. Direction of gas and liquid shall also be marked.

4.6 PROTECTIVE COATING OVER INSULATION

To provide mechanical strength and protection from damage all pipe / duct insulated with nitrile rubber as indicated in BOQ shall be covered with fiberglass fabric of 7 mil minimum thickness.

Insulated pipes & ducts exposed to UV rays shall be covered with fiberglass fabric. Over fabric one coat of fire proof epoxy or acrylic compound shall be applied. The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

Closed cell cross linked polyethylene foam shall be provided with factory laminated metallised film foil.

4.7 MEASUREMENT OF INSULATION

Unless otherwise specified measurement for duct and pipe insulation for the project shall be on the basis of centre line measurements described herewith

- a. Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements described earlier. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers are separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding, valves, orifice plates and strainers shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.
- b. Duct Insulation and Acoustic Lining shall be measured on the basis of surface area along the centre line of insulation thickness. Thus the surface area of externally thermally insulated or acoustically lined be based on the perimeter comprising centre line (of thickness of insulation) width and depth of the cross section of insulated or lined duct, multiplied by the centre-line length including tapered pieces, bends, tees, branches, etc. as measured for bare ducting.

5.0 QUALITY ASSURANCE, INSPECTION, TESTING AND COMMISSIONING

5.1 SCOPE

The following quality assurance, inspection, testing and commissioning procedures shall be required to be carried out upon award of work.

- I. Provide quality assurance program (QAP), works quality assurance program (WQAP), field quality assurance program (FQAP) and quality plan.
- II. Tests at manufacturer's works.
- III. Perform site tests and commissioning.

5.2 SUBMITTALS

- I. After award of work following information shall be submitted.
 - a. Quality Assurance Program (QAP)
 - b. Works Quality Assurance program (WQAP)

- c. Field Quality Assurance Programme (FQAP)
- II. For inspection and testing, submit inspection and testing procedures, program, and record sheets applicable at each hold point.
- III. After completion of testing, submit test records, packaging, transportation and storage instructions and methods.
- IV. For site installation and commissioning, submit installation methods or procedures, notification and procedures for pre-commission and commissioning.
- V. After commissioning, submit the site test records, 4 sets as-built drawings, manufacturer's operation maintenance manuals and list of recommended spares and tools.

5.3 QUALITY ASSURANCE CONCEPT AND CONTROL

- I. Minimum requirements for establishing and implementing a quality assurance program shall be applied to all aspects of the work necessary for carrying out the contract. Quality assurance shall extend to material parts, components, systems and services as a means of obtaining and sustaining the reliability of critical items, operating performance, maintenance and safety.
- II. Acceptance of the Contractor's quality assurance program does not relieve the Contractor's obligation to comply with the requirement of the contract document. If the program is found to be ineffective, then the Owner's site representative reserves the right to request for necessary revisions of the program.
- III. The Contractor is required to produce readily identifiable documentary evidence covering the extent and details of both his own and his sub contractor's quality assurances system as follows:
 - a. Quality Assurance Program (QAP)
 - b. Works Quality Assurance program (WQAP)
 - c. Field Quality Assurance Program (FQAP)
 - d. Quality Plan.
- IV. These documents shall be prepared separately and submitted to the Owner's site representative at the time of starting the work.
- V. Quality Plan and Manual shall be prepared by the contractor for all items and services to be supplied, after the contract has been placed, but before commencement of fabrication, and shall be subject to evaluation and acceptance by the Owner's site representative before start of work.

5.4 QUALITY ASSURANCE MANUAL (QAM)

- I. The QAM shall be a general comprehensive document outlining the Contractor's basic organization, policies and procedures. The information to be given in the QAM shall include but not limited to:
 - a. Quality Policy.

- b. Quality Assurance Programme
- c. Organization Structure showing inter relationships.
- d. Functional responsibilities and levels of authority.
- e. Lines of communication.
- f. Customer relations.
- g. Laboratory Facilities.

5.5 WORKS QUALITY ASSURANCE PROGRAMME (WQAP)

- I. The WQAP shall identify the Contractor's Quality Assurance Programme at works applicable throughout all phases of Contract performance, including design, procurement, manufacture, inspection and testing. It shall identify each of the program elements to be designed, developed, executed and maintained by the Contractor for the purpose of ensuring that all supplies and services comply with these specifications.
- II. The information to be given under this program shall include but not limited to:
 - a. Organization and Responsibility.
 - b. Contract Review.
 - c. Design and Document Control.
 - d. Procurement Control.
 - e. Production Control.
 - f. Control on Sub-contractors.
 - g. In-process Quality Control and Traceability.
 - h. Inspection and Testing.
 - j. Control of Non-conformances.
 - k. Corrective Action.
 - l. Control of Inspection, Measuring and Test Equipment.
 - m. Handling, Storage, Packaging and Delivery.
 - n. Records.
 - p. Quality Audits.
 - q. After - Sales Servicing.

5.6 FIELD QUALITY ASSURANCE PROGRAMME (FQAP)

- I. This program shall identify the Contractor's Quality Assurance Programme at site applicable throughout site construction, erection and commissioning. It is the underlying philosophy that the quality built into the product at works shall be maintained throughout the construction and commissioning stages.
- II. While, in principle, the FQAP shall include the items discussed in WQAP, it shall, however, be approached differently to take into account site conditions.
- III. The FQAP shall include, but not limited to the following information:
 - a. Organization and responsibility.
 - b. Control of Drawings and Documentation.
 - c. Product Checklist.
 - d. Control and Traceability of Purchased materials and services.
 - e. Receipt Inspection of materials at site.
 - f. Material Storage Control.
 - g. Inspection and Examination Procedures.
 - h. Control of Painting and Insulation Works.
 - j. Pre-commissioning.
 - k. Commissioning.
 - l. Control of Non-conformances.
 - m. Corrective Action.
 - n. Control of Inspection, Measuring and Test Equipment.
 - p. Records.
 - q. Complétion Documents.
 - r. List of recommended spares and tools.
 - s. Personal Training.
 - t. Servicing during Defects Liability Period.

5.7 QUALITY PLAN

- I. The contractor shall be required to prepare manufacturing and construction/erection quality plans for all equipment items and services. The quality plan shall also define the involvement of Owner's site representative in the inspection and test programs.
- II. The Quality Plan shall incorporate as appropriate:

- a. Charts indicating flow of materials, parts and components through manufacturing quality control inspection and test to delivery and erection.
- b. The charts shall indicate the location of hold points for quality control, inspection and test beyond which manufacture shall not continue until the action required by the hold point is met, and the documentation required is generated.
- c. The control documents associated with each hold point, i.e. drawings, material, specification, Works Process Schedule (WPS), Process Quality Records (PQR), quality control methods and procedures and acceptance standards.

5.8 SITE QUALITY CONTROL SECTION

- I. The Contractor's Quality Control (Q.C.) section shall be headed by an experienced Quality Control Engineer. He shall be assisted by other supervisors. The section shall be an independent one, reporting to the contractor's Site Manager only on administrative matters, but otherwise under full control by the Contractor's Corporate Quality System Management.
- II. The Contractor's Q.C. Section shall liaise closely with the Owner's site representative in charge of Quality Assurance/Quality Control, and to whom it shall give fullest cooperation. It is the underlying principle of this contract document that while the Contractor's Q.C. Engineer implements the Contractor's Quality Programme, the adequacy and effectiveness of that implementation shall be audited by the Owner's site representative whose recommendations on improving or maintaining quality shall be acted upon promptly by the Contractor's Q.C. Section.

5.9 INSPECTION AND TESTING

- I. All equipment and components supplied may be subjected to inspection and tests by the Consultant/ Owner's site representative during manufacture, erection/installation and after completion. The inspection and tests shall include but not be limited by the requirements of this contract document. Prior to inspection and testing, the equipment shall undergo pre-service cleaning and protection.
- II. Tenderers shall state and guarantee the technical particulars listed in the Schedule of Technical Data. These guarantees and particulars shall be binding and shall not be varied without the written permission of the Owner's site representative.
- III. No tolerances shall be allowed other than the tolerances specified or permitted in the relevant approved Standards, unless otherwise stated.
- IV. If the guaranteed performance of any item of equipment is not met and / or if any item fails to comply with the specification requirement in any respect whatsoever at any stage of manufacture, test or erection, the Owner's site representative may reject the item, or defective component thereof, whichever he considers necessary; and after adjustment or modification as directed by the Owner's site representative, the contractor shall submit the item for further inspection and /or test.

- V. The approval of the Owner's site representative of inspection and/or test results shall not prejudice the right of the Owner's site representative to reject an item of equipment if it does not comply with the contract document when erected, does not or prove completely satisfactory in service.
- VI. The Contractor shall be responsible for the timely transmission of the relevant and appropriate sections of the contract document to manufacturers and sub-contractors for the proper execution of all tests at their works as per contract specifications.

5.10 TESTS AT MANUFACTURER'S WORKS

- I. All tests to be performed during manufacture, fabrication and inspection shall be agreed with the Consultant/ Owner's site representative prior to commencement of the work. The Contractor shall prepare the details of the schedule and submit these to the Consultant/ Owner's site representative for approval. It must be ensured that adequate relevant information on the design code/standard employed, the manufacture /fabrication/assembly procedure and the attendant quality control steps proposed are made available to the Consultant/Owner's site representative who will mark in the appropriate spaces his intention to attend or waive the invited tests, or inspections.
- II. A minimum of 10 days' notice of the readiness of equipment for test or inspection shall be provided to the Owner's site representative by the Contractor (whether the tests be held at the Contractor's or Sub-contractor's works). The subject items should remain available for Owner's site representative inspection and test up to a minimum 10 days beyond the agreed date of witnessing the test. Every facility in respect of access, drawings, instruments and manpower shall be provided by the Contractor and sub-contractor to enable the Owner's site representative to carry out the necessary inspection and testing of the Plant.
- III. No plant shall be packed, prepared for shipment, or dismantled for the purpose of packing for shipment, unless it has been satisfactorily inspected, all tests called for have been successfully carried out in the presence of the Owner's site representative or approved for shipment, or alternatively inspection has been waived.
- IV. Functional electrical, mechanical and hydraulic tests shall be carried out on completed assemblies in the works. The extent of these tests and method of recording the results shall be submitted to, and agreed by, the Owner's site representative in sufficient time to enable the tests to be satisfactorily witnessed, or if necessary for any changes required to the proposed program of tests to be agreed.
- V. The Consultant/Owner's site representative reserves the right to visit the Manufacturer's works at any reasonable time during fabrication of equipment and to familiarize himself with the progress made and the quantity of the work to date.
- VI. Within 30 days of completion of any tests, triplicate sets of all principal test records, test certificates and correction and performance curves shall be supplied to the Owner's site representative.

- VII. These test records, certificates and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Owner's site representative or not. The information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificate refers and should also bear the Contract reference title.
- VIII. When all equipment has been tested, the test certificates from all works and site tests shall be compiled by the Contractor into volumes and bound in an approved form complete with index and four copies of each volume shall be supplied to Consultant/ Owner's site representative.
- IX. Stage wise inspection of equipment in factory is waived.

5.11 PERFORMANCE TESTS AT MANUFACTURER'S WORKS

- I. All equipment may be subjected to routine performance tests at the Manufacturer's Works in accordance with the relevant ANSI, ASME, ASTM, BIS standard including operating tests of complete assemblies to ensure correct operation of apparatus and components.
- II. Pumps, fans, compressor, and other rotating equipment shall be given full load tests, and run to 15% over speed for 5 minutes to check vibration. Main and auxiliary gear boxes shall be subjected to shock load tests and a six-hour endurance run at rated speed and maximum torque.
- III. The Contractor shall submit single line diagrams including the layout of the Plant together with the location of test instrumentation and the principal dimensions of the layout. All calculations to derive performance data shall be made strictly in accordance with format given in the approved standards. Any alterations or deviations from the approved standard test layout or formulae shall be subjected to the prior approval of the Owner's Site Representative.
- IV. The performance test shall be conducted over the full operating range of the pump to a closed valve condition and a minimum of five measurement points covering the full range shall be taken. Curves indicating Quantity vs. Head, Quantity vs. Power absorbed, and Quantity vs. Pump efficiency shall be provided. In addition a curve of the NPSH required vs. Quantity shall be provided except when the suction conditions do not require this test. Any proposal for the omission of this test shall be to the approval of the Consultant/ Owner's site representative.
- V. On completion of the tests the Contractor shall submit a report showing the test results obtained together with the curves corrected to the site operating conditions.