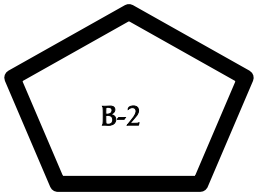

TENDER DOCUMENT

NAME OF THE WORK-

PROPOSED HVAC, ACOUSTICS & INTERIOR WORKS AT THE TRAINING CENTRE FOR BAR COUNCIL OF MAHARASHTRA AND GOA AT PLOT NO. X-39, TALOJA MIDC, MUMBAI.

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

T E N D E R N O T I C E

Sealed items rate tenders invited by the undersigned from Experienced and Reputed Contractors, in **Two Cover** system for **Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.**

Name of Work	**Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.**
Total Built Up Area of Project	: Approximately 5000 Sq. Mt.
Area of Construction	: Same as above
Earnest Money Deposit	: Rs-3,00,000/- (Rupees Three Lacs Only)
Security Deposit & Retention Money	: Total 5% Security Deposit which includes 2.5% initial Security Deposit. (Inclusive EMD amount), to be paid at the time of Work Order and Balance 2.5% as Retention amount, to be Deducted from RA bills at minimum 10% of the Billed amount for each bill.
Time limit For Construction of Work	: 03 (Three) Months (Including Monsoon Season) : Note- The HVAC work for the Residential Building – Phase I shall be carried out and completed within one month after the construction of the building is completed.
Tender Form Fees	: Rs 5,000/- +**GST 18% i.e. Rs 5,900/- in Cash**

Blank tender forms will be available from 21.05.2025 (After 3:00 PM) to 26.05.2025 (Up to 5:00 PM) during office working hours of the Architect M/S **MITIMITRA CONSULTANTS PVT. LTD.** 1st Floor, Arthabodha, 968/21-22, Senapati Bapat Road, Pune 4110162, Ph 020-25651228/ 0218. e-mail: mitimitra@gmail.com

Pre-bid meeting will be held on 29/05/25 at 11:00 AM in office of **The Chairman, Bar Council of Maharashtra & Goa,** 2nd Floor, High Court Extension, Fort, Mumbai 400032 or any other location and time that will be notified to the Bidders through email.

Duly filled Tenders shall be submitted in the office of **The Chairman, Bar Council of Maharashtra & Goa,** 2nd Floor, High Court Extension, Fort, Mumbai 400032, on 04.06.2025 By 3:00 PM

Tenders will be opened in the office of **The Chairman, Bar Council of Maharashtra & Goa**, in the presence of the attending tenderer if any, on 04.06.2025 After 3:00 PM or any other date which will be notified to the bidders.

The Earnest money should be paid only by D.D from Nationalised Bank drawn in favour of **Secretary, Bar Council of Maharashtra & Goa**.

Secretary, Bar Council of Maharashtra & Goa reserves the right to reject any or all the tenders without assigning any reasons.

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

TENDER SCHEDULE :-

Seq. No.	Stage		
		Date	Time
1	Document Sale Start date	21.05.2025	03:00 PM
2	Document Sale End date	26.05.2025	05:00 PM
3	Pre-bid	29.05.25	11:00 AM. Any change will be notified by mail
4	Bid Submission End date	04.06.2025	03:00 PM
5	Bid Opening date	04.06.2025	After 03:00 PM
6	Site Visit if required	06.06.2025 & 07.06.2025	Date may change and will be notified if changed
7	Negotiations and finalisation of Agency	11.06.2025	11:00 AM

If required, the Site visits to the works completed / ongoing works of the bidders, will be carried out by members of Bar Council / Architects to ascertain quality of construction, timely schedule followed, procedures and standards adopted at site working, safety measures carried out at site, etc. Based on this site assessment report further shortlisting of eligible bidders will be made, of whom financial bids will be opened.

Site selected should be of similar nature (work completed) for visit and should have an area within a variance not more than 20%.

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

List of Documents to be submitted physically in Cover – I :

a. Earnest Money Deposit.

b. **Criteria for Bidder** :- Attested copies of Original Work Completion Certificate for last Five financial years (i.e. 20-21, 21-22 ,22-23, 23-24, 24-25) from Government / Semi-Government / Reputed Educational Institutes / Trust / Institute etc. (**Note** : Experience from Private ownership Projects / Developers & Builders / Real Estate will not be considered) for Similar type of **HVAC, Interior and Acoustical Work**

- for a single Project of similar nature costing more than Rs. 3.00 Crore. or
- Two Projects of similar nature costing more than Rs. 1.75 Crore or
- Three Projects of similar nature costing more than Rs. 1.25 Crore

c. Attested copies of Abstract of work done (Average Annual Financial Turnover from Charted Account) for more than Rs. 5.00 Crore each year in all classes of Civil Engineering Construction work including Interior Work, during last five financial years.

d. Scanned copies of Partnership Deed / Registration Certificate in case of Pvt. Ltd. Company with list of Directors their names and address with telephone numbers, if the tenderer is a partnership firm / Pvt. Ltd. Company, Power of Attorney / resolution of Board of Director's for authorized signatory.

e. Hard copy of Declaration regarding any ongoing disputes / litigations (or any history thereof) with respect to any work executed / being executed by the tenderer with details of disputes/litigations, if applicable.

f. Scanned Copy of Original GST Certificate (Registration Number) issued by GOI.

g. Hard copy of Notarized Affidavit on a Stamp Paper of Rs 100, duly signed by the contractor regarding completeness, correctness & truthfulness of documents and statements attached in the Cover-1 of this Tender.

NOTE: All the documents at Sr. No **a - g** shall be submitted by the bidder in COVER No. I correctly and completely otherwise he will be **"Disqualified"** and his **COVER No. II** will not be opened. Even though the Bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the Statements, attachments submitted in proof of the qualification requirements.

Financial Bid to be submitted in Cover II – After the Scrutiny of the Technical Bids (Cover – I), Financial Bids (Cover – II) will be opened ONLY for qualified bidders whose technical bid is accepted.

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

FORM OF TENDER

1. Having examined the Instructions to Tenderers, the Conditions of contract, the Form of Bond relating to the scope of work and having delegated a capable and competent person to visit the site on our behalf and having obtained all the information regarding the works and relating to the subject of this render, we the undersigned hereby offer to construct and maintain the whole of the said works in conformity with the contract documents, comprising the Tender documents and schedules, Graphs, Charts, Tables, letters and attachments as set out in the List of Contract Documents hereto annexed and in accordance with the terms of the following Tender for the total sum of :

   "Rupees ----------"

2. We hereby undertake if this tender is accepted:
   a. That we will execute if called upon to do so, an Agreement in the Form annexed hereto with subsequent modification by the employer if any.
   b. That notwithstanding that such, Agreement shall not have been executed we will commence the work within two weeks of receipt by us of the order by the Employer to commence the works and:
   c. That we will complete and deliver the whole of the works comprised in the contract Documents within 3 months calculated from the last day of the aforesaid period in which the works are to be commenced.
3. If the Tender is accepted, we agree to obtain at our own expenses the demand draft of a Bank to be jointly and severally bound with us in the sum stated below for the due performance of the contract in the terms of Bond in the form annexed hereto with subsequent modifications by the Employer, if any, we propose for your approval as surety the following Bank who have signified their willingness to act.

   Name of the Bank ----------

   Address ----------
4. We understand that this Tender and subsequent Contract are to be regarded as Confidential and no matters contained in or concerning the same should be disclosed to any persons / organisations etc outside the scope of the Contract without express permission of the employer.
5. We undertake to abide by this Tender for the period of 90 days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
6. Until such time as an official agreement signed by both parties has been drawn, this offer, together with your written acceptance thereof in the form of a Letter of intent, shall be regarded as a contract binding to both parties.
7. In the event of any of the conditions upon which you accept this Tender not being complied with by us or in the event of our failing to start the construction work as aforesaid of such agreement within 15 days we hereby authorise you to rescind the acceptance of our tender but this provision is to be without prejudice to any other rights or remedies you may have in respect of such failure.
8. It is understood that you are not bound to accept the lowest or any tender submitted.

Signature of Contractor.

INSTRUCTIONS TO TENDERERS

1. The tenderer is required at his expense, to obtain all the information he may require enabling him to submit his tender materials, labour etc. and is required to comply with the requirements of the local / Government / Public authorities in such matters.
2. A schedule of approximate quantities for various items accompanies this Tender. The Consultant does not accept any responsibility for the correctness or completeness of this Schedule in respect of items and quantities and is liable to alteration of the consultant by omissions, deductions or additions at the discretion of the consultant without affecting the terms of the contract.
3. Questions regarding the meaning of any of the Tender Documents shall be directed to the consultant at least 3 days prior to the date fixed for Tender opening. The consultants shall clarify and answer all the questions from all the tenderers in writing.
4. No claims as regards want of information of any particular point or any change in rate or conditions shall be entertained after the opening of tender.
5. Only those tenders, fully completed in writing, Sealed and signed by the Tenderer on the Form of Tender together with all the documents and received by the time and date specified hereunder will be considered. All copies of drawings should be returned unmarked.
6. Each page of the Tender document shall be initialled by the Tenderer before submission.
7. **The tenderer shall submit Rate analysis for any items as may be demanded by Client / Consultant, during the Tendering Process**
8. If any alterations are made by the Tenderer in the Tender documents, the tender may be liable for rejection.
9. All information supporting the tender shall be in English and all entries made by hand and written in ink. There shall be no overwriting or erasure. All corrections should be attested by the Tenderer with his seal & sign dated as many times as the corrections occur.
10. The tenderer should fill in the rates tendered in figures as well as in words. The amount for each item should be worked out and the requisite totals given.
11. If on check, differences are found between the rates given by the tenderer, in words and figures or in the amounts worked out by him, the following procedure shall be followed:
    - i) Where there is difference between the rates in figures and in words, the rates which correspond to the amounts worked out by the tenderer shall be taken as correct.
    - ii) Where the amount of an item is not worked out by the Tenderer or it does not correspond with the rate written either in words shall be taken as correct.
    - iii) Where the rates quoted by the tenderer in figures and in words tally but the amount is not worked out correctly, the rate quoted by the tenderer shall be taken as correct and not the amount.
12. The tenderer is required to check the numbers of the pages and should any be found missing or in duplicate or the figures or writing indistinct, he must inform the Consultant at once and have the same clarified.
13. The tender shall remain valid for acceptance for a period of 90 days counted from the day following the latest date fixed for receiving tenders.
14. The tender sum and pricing of Bill of Quantities shall be given in the Indian currency.
15. The Tenderer whose tender is accepted will be required to enter into an agreement with the Employer which will be prepared by the Architects and signed by owners and contractors.
16. All the works shall include Material, Labour & Supervision component to achieve the quality of works / finish standards as approved by the Architect. These rates shall be binding & at these rates Payment shall be made to the Tenderer for the actual executed quantities.

17. The Tenderer to produce Material Samples / prepare Workmanship Samples from time to time for approval prior to executing of works, whenever necessary or as directed by Architect.
18. The Tenderer shall give Performance Guarantee for a period of 10 Years after Virtual completion in the form of Indemnity Bond for the items of Water Proofing Treatment of all types etc. Indemnity Bond to be given in the Format approved by the Architect.
19. No Mobilisation Advance / Advance against Material brought on Site, shall be made.
20. No Escalation clause is applicable for this Tender, and NO claims shall be entertained regarding this.
21. The Owner / Architect reserves the right to cancel / reduce / alter the scope of work. The Tenderer's Rates shall be firm, and no variations shall be allowed due to variation in final executed quantities. The Quantities mentioned in the Bill of Quantities are indicative.
22. Any Extra Item if required to be executed, shall be first got approved from the Client / Architects and Rate for Extra Items shall be arrived at using the State Schedule of Rates for current Year followed by State PWD or rate analysis in case item is missing from the State Schedule of Rates, prior to execution of the said extra work. No claim shall be allowed later, on completion of works.
23. The Tenderer shall Liaison with various Agencies / Suppliers to short list best of available materials, obtain sample of materials for the approval. Permissible Wastage for any Material, if supplied by the Owner shall be limited to the extent of 5%.
24. The Owner / Architect reserves the right for permission to appoint any Sub Contractor to execute any specific Items of work. Tenderer shall not claim any extra rate / amount the for the same. Tenderer shall Coordinate with the Sub Contractor in the executing the work.
25. All the Plant, Machinery, Equipment, Tools, Scaffolding etc. required for the execution of any Item of work shall be arranged by the Contractor & no extra payment shall be made for the same. The Tenderer to use double scaffolding and or multi stage scaffolding, wherever required at no extra cost.
26. Tenderer to Liaison with authorities for all works. He shall obtain various N.O.C's required such as drainage , water supply, vermiculture, road, encroachment, garden and any other NOC /condition put by PMC at that prevailing time to obtain Occupancy Certificates from the Local Authorities. The necessary Drawings shall be supplied at the prevailing cost per drawing.
27. Tenderer to employ Licensed Plumber for all the Plumbing, Drainage works and Licensed Electrician for all the Electrical works.
28. It is assumed that the Tenderer has visited the site and is aware of all the Site Conditions, Services available in the vicinity. It is also assumed that the Tenderer has **studied all the Tender / Working Drawings** and is fully acquainted with all the Items of work to be executed.
29. The Tender should be **Unconditional.** Any **Conditions,** accompanying the Offers shall not be accepted.
30. The Tenderer shall **indemnify** the owners against any claim, loses etc. arising due to labour laws, Insurance, Accident Relief etc.
31. On completion of works, Tenderer shall **remove all debris, temporary structures,** all the tools, plant & machinery. He shall hand over the works executed in workmanship manner as directed by the Architect.
32. It is assumed that the rates quoted by the Tenderer **cater all heights.** No extra Payment shall be made for any item of works to be executed at different heights / levels except mentioned in BOQ Items.
33. Water will not be given by Employer on Work Site at all; the Tenderer shall have to make his own arrangement for the supply and distribution of water at his own Cost. Tenderer has to make additional arrangements such as obtaining required permissions for laying pipe line network, storage facility etc. at his own Cost.
34. The Tenderer shall obtain **Contractor All Risk Insurance Policy** from the Govt. Insurance Fund, & it is kept in force till the expiry of the Defect Liability Period and no extra payment shall be made for the same.

35. The Tenderer shall insure the works including the all insurances in respect of Damage to Persons and Property at his own cost and keep them insured until the Virtual completion of Contract. The Tenderer shall deposit the Policy and receipt for the premiums in original with Architect within the 2 weeks from the date of signing of the Contract.
36. For all works, the Mode of Measurement shall be on actual basis. No factor of Multiplication shall be applied for any item of work.
37. Taxes & Duties : The Tenderer shall be responsible to pay to appropriate Authorities i.e. WORKS CONTRACT TAX, VAT, ALL OTHER TAXES, LEVIES, OCTROI, ROYALTIES, INCOME TAX, SALES TAX, EXCISE DUTIES, GST, LBT & ANY OTHER TAXES as applicable from time to time.
38. No Interest shall be payable on any Amount payable to the Tenderer under the Contract.
39. Mobilization Period for Tenderer shall be 1 week from the date of Letter of Intent.
40. **Testing of Material:** The Tenderer should Conduct any Test on any Material / Work from time to time as required by Client / Architects / Consultants at his own Cost. He should produce Test Results from Authorized Department & maintain record of the same. Testing of the Materials would be allowed in the Site Laboratory if the same is established by the Tenderer at his own cost and to the entire Satisfaction of the Architect and Consultants. If required by client,
41. **The frequency of Material / Item Testing shall confirm with the frequency SET by Public Works Department, Govt. of Maharashtra**
42. **Mix Design for ALL RCC Items shall be conducted and got approved by the Client / Architect / Consultant**
43. Owner may or may not supply any of the Materials at Site from his own Source. Necessary deduction for the same shall be made for the Material in the Current Running Account Bill against the respective Items.
44. The Quantities given in the Bill of Quantity are Indicative. Tenderer shall be paid as per the actual quantities executed after making measurements at Site. If there is any variation in Quantity, and if there is any deletion of any Item, no extra claim by the Tenderer shall be allowed.
45. If there is any change in Scope/change in Specification the Tenderer should execute the same. He should obtain the approval for the rate of the same from the Architect before execution of the same.
46. No further Claim shall be made by the Tenderer after submission of the Final Bill and these shall be deemed to have been waived and extinguished.
47. Deviation Limit. No extra claim by the Tenderer shall be allowed.
48. The Tenderer shall at his own cost, provide and maintain at the site of works a standard First Aid Box as directed/ approved by the Architect for the use of his own as well as the Owner's Staff / Labours on Site.
49. Field Books etc. : When Payment is based on the Levels, Actual Measurements etc. taken on Site in presence of representative of Tenderer and Owner & Counter Signed by both. So the Tenderer should maintain the proper Field Books etc.
50. The Tenderer shall comply with **Fire Regulations** of the Controlling authority in force at the site of works relating to the precautions to be taken against Fire Hazards.
51. Adequate **Protection** against any form of damage or deterioration shall be provided for all sections of the works. This shall include protective tapes, casings, guardrails etc.
52. The Tenderer shall within 24 Hours of the occurrence of any **Accident** on or about the site, or in connection with the execution of works, report such accidents to the Owner and to the appropriate Authority wherever Law requires such report.
53. The **Contract shall be terminated** at any time during the execution of work by the Owner / Architect. If the work is not to the Satisfaction of the Architect or if there is misbehavior from the Tenderer Side without any extra Claim.

54. The Tenderer will be asked to Redo the same at his own cost till to the satisfaction of the Architect and to the above Functional Point of View is achieved.
55. Owner **Reserves Full Right to reject** any or all the Tenders without assigning any reason and the Selection shall be at the entire discretion of the Owner & the Owner's decision in this respect shall be final and binding. Further, Owner reserves right to split the work in two or more Stages without any Compensation for reducing the Cost of the Project. This shall be entire discretion of the Owner and the Owner's Decision in this matter shall be final and binding and without appeal.

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

BIODATA OF CONTRACTOR: -

1. Name of the Contractor/ firm
2. Constitution of the firm, partnership Or Private Limited, and qualification of Partners
3. If it is Private of Public Limited details pertaining to firm
4. Address and Telephone No
5. Address of the Bankers
6. Work In Hand Details -in following Proforma

Sr.No	Project Owner (Client) with Contact Details	Name of Work	Brief Scope of Work	Value of Work in Lakhs	Time Allotted for Completion	Present Stage	Remark
1.							
2.							
3.							
4.							
5.							

Enclose copies of Work Orders from Institutions / Public or Private limited Companies

7. Major works Executed (Completed) in following Proforma

Sr. No	Owner of Project – Client with Contact Details	Name of Work	Brief Scope of Work	Value of Work in Lakhs	Work Start Date	Work Completed Date	Remarks
1.							
2.							
3.							
4.							
5.							

Enclose copies of certificate from Institutions/ Public or Private limited Companies, after successful completion Of work….

8. Plant Machinery and Equipment -- details

S.No.	Name Of Plant / Machinery	Make Details	Quantity	Remarks
1				
2				
3				
4				
5				

9. Working Staff with their qualification and experience

S.No.	Name of Staff with Contact Details	Qualification	Post Held	From Date	Remarks
1					
2					
3					
4					
5					

SIGNATURE OF THE CONTRACTOR

Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

BID AND LETTER FROM CONTRACTOR

To,

Subject : Construction of Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.

1. Having inspected the site and having examined the drawings, General and special conditions of Contract, Schedule "A", Specifications and Bill of Quantities for the above named work, we, the undersigned offer to construct, complete and maintain for 24 months the entire work free of defects for the sum of Rupees----------(Rupees ----------) on item rate basis mentioned in the Schedule of Quantities, or such other sum as may be ascertained in accordance with the said conditions, all in conformity with the said drawings, conditions of contract, specifications, Bill of Quantities and Schedules.

2. Our Bid is accompanied with earnest Money of Rs. ----------(Rupees ----------) as required in the instructions to the Bidders. If our Bid is accepted, we agree to your terms of security deposit as stated in the Detailed Tender Notice:

   We authorise you to deduct 2.5% from our Running Account Bill to make the total security deposit of the Contract price referred to above.

3. We undertake, if our Bid is accepted, to commence the works and complete and deliver the same within the time stipulated in the special conditions of Contract and the note attached to it.

4. We agree to abide by this Bid for a period of 90 days from the date fixed for receiving the same and it shall remain binding on us and may be accepted at any time before the expiry of that period and / or before the expiry of any further period extended in mutual consent.

5. In case of default by us in any of our obligations in paragraphs 2,3, and 4 above, we acknowledge, you are at liberty to forfeit the Earnest Money deposited herewith.

6. Until and unless a formal agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us together with all the General and special Conditions of Contract, Specifications, Bills of Schedule of Quantities and Prices, Appendix Drawing detailed in the Specifications and Instructions to Bidders.

SEAL OF THE BIDDING CONTRACTOR COMPANY. **SIGNATURE OF THE BIDDER**

FORM OF BANK GUARANTEE

THIS GUARANTEE BOND made this ----------day of ----------of the year ----------by the and having its Registered Office at ----------

(hereinafter called the "Bank"). Which expression shall include its successor and/or assignees in favour of ----------having its Registered Office at ----------(hereinafter called the "employer" which expression shall include its successors and / or assigns);

WHEREAS in pursuance of an Agreement entered into (hereinafter called "The Agreement") between the Employer and ----------(hereinafter called the "the Contractor:") for work as Contractors for Construction, completion and Maintenance of works as specified and as per the Terms of the Agreement.

NOW THESE PRESENTS WITNESS AS FOLLOWS:-

That in consideration of the Employer having agreed to appoint M/S----------as the Contractor and agreeing to make an advance payment of Rs.---------- to the Contractor, the Bank hereby agrees to the following :

If the Employer feels that the advance paid cannot be recovered from their future running bills, the advance paid or the lesser amount that may be remaining unpaid/unadjusted by the Employer on that date shall become payable to the Employer forth with on demand.

This Guarantee shall come into force simultaneously with the receipt of advance payment or part thereof by the Contractor and/or from the date of execution of a Contract between the Employer and the Contractor and the Bank shall be liable to make payment to the Employer on demand. Forthwith without recourse to the Contractor or to any other person.

This Guarantee shall not be discharged or revoked by the in solvency or winding up of the Contractor's business nor shall it be affected by any change in the constitution of the Contractor's concern or that of the Bank.

Thus it is expressly agreed that all legal proceedings in regard to this Bond shall fall within the exclusive competence of such Court as having jurisdiction in the matter of respect of the Agreement between the Employer and the Contractor.

IN WITNESS WHEREOF the Bank has executed presents the day and year first written above.

ARTICLES OF AGREEMENT

ARTICLES OF AGREEMENT made the ---------- day of ----------2025:

BETWEEN

Bar Council

(HEREINAFTER CALLED 'THE EMPLOYER') Of the ONE PART:

AND

(Whose Registered office is situated at ----------)

(Hereinafter called 'THE CONTRACTOR') of the OTHER PART:

WHEREAS the Employer is desirous of constructing building at drawings and specifications describing the work to be done to be prepared by M/s Mitimitra Consultants Pvt Ltd, Architects:

AND WHEREAS the Contractor has agreed to execute upon and subject to the conditions set forth herein and to the Conditions set forth in special conditions and in Schedule of Quantities and conditions of Contract (all of which are collectively hereinafter referred to as "The said Conditions" the works shown upon the said drawings and/or described in the said specifications and included in the said schedule of Quantities at the respective rates therein set forth amounting to the sum as therein arrived at or such other sum as shall become payable hereunder (herein after referred to as "The said Contract Amount")

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the said Contract Amount to be paid the time and in the manner set forth in the said conditions and complete the work shown upon the said Drawings and described in the said specification and/or the schedule of Quantities.
2. The Employer shall pay the contractor the said Contract Amount or such other sum as shall become payable at the time in the manner hereinafter specified in the said conditions.
3. The term consulting Engineer in the said Conditions shall mean the said Consultant Mr And in the event of his ceasing to be the for the purpose of this Contract such other person or the persons as may be nominated for that purpose by The employer, not being a person who whom the Contractor shall object for reasons Considered to be sufficient by the employer PROVIDED ALWAYS that no person or Persons is subsequently appointed to be Consultant under this Contract shall be Entitled to disregard or overrule any previous decision or approval or direction given Or expressed in writing by Consultant for the time being.
4. The said conditions and Appendix thereto shall be read construed as forming part of this Agreement, and the parties shall respectively abide by, submit themselves to the conditions and perform the agreements on their part respectively in the conditions contained.
5. The plans, agreement and documents mentioned, herein shall form the basis of this contract and the decision of the consultant, as mentioned in the conditions of Contract in reference to all matters of dispute as to material workmanship and as to the intended interpretation of the Clauses of agreement of any other document attached thereto shall be final and binding on both parties, as may be a rule of the court.
6. This contract is neither a fixed lump-sum contract nor piece work contract but is a Contract to carry out work in respect of this entire building, to be paid for, according to accurate measured quantities

at the rates containing in the schedule Rate and Probable Quantity or as provided in the said conditions.

7. The employer through the Architect reserves to himself the right of altering the drawings and nature of the work of adding to or omitting any items of work or having portions of the same carried out without prejudice to this contract.

8. The said conditions 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 part respectively in such conditions contained.

9. Time shall be considered as of the essence of this Agreement and the Contractor Hereby agrees to commence the wok soon after the site is handed over to him as provided for in the said conditions and to complete the provisions for extension of time.

The employer reserve their right terminate this contract in case the contractor fails to adhere to work time schedule attached herewith, if the delay is not satisfactorily explained and/or improper shoddy execution of the work not to the satisfaction of the Consultant.

10. All disputes arising out of or any way connected with this Agreement shall be deemed to have arisen in Pune, and the Consultants shall have jurisdiction to determine the same.

The several parts of this Contract have been read to us and fully understood by us.

IN WITNESS WHEREOF the parties hereto have hereunto out their respective hands this ---------- day of ----------2025

Signed by

In the presence of

Address

Occupation

Signed by

In the presence of

Address

Occupation

APPENDIX HEREINAFTER REFERED TO AS FACE SHEET

1. Name of work	**Proposed HVAC, Acoustics & Interior works at the Training Centre for Bar Council of Maharashtra and Goa at Plot No. X-39, Taloja MIDC, Mumbai.**
2. Site of work	At Taloja Mumbai.
3. Name of the Employer	The Chairman, Bar Council of Maharashtra & Goa 2nd Floor, High Court Extension, Fort, Mumbai 400032
4. Name of the Architect	**MITIMITRA CONSULTANTS PVT. LTD** 1st Floor, Arthabodha, 698/21-22, Senapati Bapat Road, Pune 4110162, Ph 020 25650218, 020 65220218 e-mail: mitimitra@gmail.com
5. Defects Liability Period	Two years (24 months which should be Include Rainy Seasons)
6. Period of final measurement	1 month after virtual completion.
7. Liquidated Damages	at the Rate of Rs. 5,000/ per day
8. Value of work for interim payments (Running Bills)	Rs. 2.00 Cr
9. Period for Running Bills	1 month Minimum
10. Period for honouring Certificate	30 Days.

THE CONDITIONS HEREIN REFERRED TO AS GENERAL CONDITIONS OF CONTRACT

1. The contract document shall consist of the Agreement, the General Conditions of the Contract, Specifications, and bills of quantities including all modifications thereof incorporated in the documents before the execution and the contract drawings prepared by Architect time to time. All these form the contract.

   a. In constructing these conditions, the interpretations, specifications, schedule of quantities and contract document, the following shall have the meanings herein assigned to them except where the subject or context otherwise required.

i.	"Employer"	: Shall mean The Chairman, Bar Council of Maharashtra & Goa 2nd Floor, High Court Extension, Fort, Mumbai and shall include his (their) legal representative/s assignee/s or successors.
ii.	"Contractor"	: Shall mean the individual or the firm or company whether incorporated or not, undertaking the works and shall include his (their) legal representative/s, assignee/s or successors.
iii.	"Architect / Project Management Consultant	: Shall mean the said "**MITIMITRA CONSULTANTS PVT. LTD** 1st Floor, Arthabodha, 698/21-22, Senapati Bapat Road, Pune 4110162, and their authorized nominee and representative or such other firms/ person nominated by the employer, which unless otherwise specified shall be deemed to include the (PMC) appointed by the employer
iv.	"Sub-contractor"	: Shall mean those having a direct contract with the contractor and it includes one who furnishes material worked to a special design according to the plans or specifications of this work, but, does not include one who merely furnished material not so worked.
		: Any one doing a piece rate basis shall be deemed; a sub-contractor
v.	"Work"	: Shall mean all the work to be executed in accordance with the contract or part(s) there of as the case may be and shall include all extra and additional works/items or temporary and urgent works required for the performance of this contract.
vi.	"Site"	: Shall mean the site of the Contract works including any building and erections thereon and any other land (inclusive) as aforesaid allotted by the Employer for the Contractor's use for the purpose of this contract
vii.	"This Contract"	: Shall mean the notice inviting the tender and the acceptance thereof and the formal agreement if any executed between BAR COUNCIL and the contractor together with the documents referred to therein including the Articles of Agreement, the General conditions, the Appendix, the special conditions, the specifications, designs, drawings, schedule of quantities with rates and amount and schedule of rates, attached hereto and duly signed.

viii. "Notice in writing" : Or written notice shall mean a notice in writing, typed or printed Characters sent, unless delivered personally or otherwise shall be deemed to have been received when in the ordinary course of post it would have been delivered to the last business address known to him who gives the notice.

ix. "Contract sum" : Shall mean, in case of item rate contracts the cost of works arrived at after extension of quantities shown in the schedule of quantities by the item rates quoted by the tenderers for various items.

x. "Temporary works" : Shall mean all the temporary works of every kind required in or about the execution, completion, or maintenance of the works.

xi. "Urgent works" : Shall mean any urgent measures which in opinion of the architect become necessary during the progress of the work to obviate any risk of accident or failure of which becomes necessary for security.

xii. "Act of insolvency : Shall mean any Act of Insolvency as defined by Presidency Town Insolvency Act, or the Provincial Insolvency Act or any act amending such original.

xiii. "Net prices" : if in arriving at the contract amount, the contractor shall have added to or deducted from the total of the items in the tender any sum, either as percentage or otherwise, then the net price of any item in the tender shall be the sum arrived at by any adding or deducting from the actual figure appearing in the tender as the price of that item in similar percentage or proportionate sum. Always provided that in determining the percentage or proportion of the sum to be added or deducted by the contractor, the total amount of any prime cost items and provisional sum of money shall be deducted from the total amount of the tender. The expression "net Prices" or "net rates" when used with reference to the contract or account shall be held mean rates or prices so arrived at.

xiv. "Material to be supplied by the Owner/ Employer : material to be supplied by the owner / employer / client shall mean the material which the client shall supply to the contractor and shall be supplied as per conditions of section "Material to be supplied by Client:

xv. "Expected Risks" : are the risks due to riots (otherwise than among contractor's employees) and civil commotion (in so far as both these are uninsurable), war(whether declared or not), invasion, act of foreign enemies, hostilities, civil war, rebellion, revolution, insurrection, military or unsurped power, any acts of Government, damage from aircraft, cts of God, such as earthquake, lightening and unprecedented floods and other causes over which the contractor has no control and accepted as such by Architects.

xvi. "Market rates" : Shall be at the rate as decided by the Architect/ Consultant based on the cost of material and labour at the site where the work is to be executed, plus the percentage mentioned in Appendix to cover all overheads and Profit.

xvii. "A day" : Shall mean a day of 24 hours from midnight to midnight irrespective of the number of hours worked in that day.

xviii. "A Week" : Shall mean seven days without regard to the number of hours worked in any day in that week.

b. They (mentioned in sub-clause (i) to (iv) are treated throughout the Contract Document as if each were a singular number and masculine gender.

c. The Law of the place of work shall govern the construction under this contract.

d. The date of virtual completion of a project or specified area of the project is the date when construction is sufficiently completed, in accordance with the contract document as modified by any change or variation orders, agreed to by the parties; so that the owner can occupy the project for use it was intended for.

2. **Contract Document – the following shall constitute the Contract document.**

a. Articles of agreement
b. General Conditions of Contract / Special conditions including Materials to be supplied by the Client
c. Technical Specifications
d. Bill of quantities.
e. Any additional Specification or condition agreed to by consenting parties at the rate of entering, or later mutually agreed upon.
f. Drawings.
g. Letter of Intent.

The Contract shall remain in the custody of the Consultant and shall be produced by him at his office as and when required by the Employer or the Contractor. The Contractor on the signing hereof shall be furnished by the Consultant free of cost with a copy for the priced schedule of quantities, one copy of each of the said Drawings and of the specifications and one copy of all further drawings required by the Contractor shall be paid for by him. The Contractor shall keep one copy of all drawings on the works and the Consultant, or his representative shall at all reasonable times have access to the same. Before the issue of the final certificate to the Contractor, he shall forthwith with return to the Architect all Drawings and specifications. The contractor shall keep one copy of the specifications, descriptive schedule or other documents referred to in this clause and one copy of the contract drawings and such other drawings and details supplied to him from time to time and referred to this clause and written instructions referred to in this clause and sub-clauses 11, 44 upon the site so as to be available to the Architects or his representatives as all reasonable times.

Upon final payment, under the clause 35.e of these conditions, the contractor shall, if so requested by the architect, forthwith return to the architect all drawings, details, specifications, descriptive schedules and other documents of like nature which bears his name and that of the consultant.

3. **Type of contract** – the contract shall be an item rate contract. The contractor shall be paid for the actual quantity of the work done, as measured at site, at the rates finally negotiated and agreed upon by the client and the contractor.

4. **Schedule of quantities -** The schedule of Quantities unless otherwise stated shall be deemed to have prepared in accordance with the Standard Method of Measurement of Building works before issued by the Indian Institute of Architects/Employers, with the exception of doors and windows, which shall be measured as openings in masonry i.e. including frames. Any error in description or in quantity or in omission of items fro the Schedule of Quantities shall not vitiate this contract but shall be rectified and the value thereof as

ascertained under Clause 4.c hereof shall be added to or deducted from the Contract Amount (as the case may be) if there shall be no rectification or errors in the Contractor's Schedule of Rates.

a. The schedule of quantities given in the contract bill area provisional and meant to indicate the intent of the work and to provide a uniform basis for tendering. The owner reserves the right to increase or decrease any of the quantities or to totally omit any item of work and the contractor shall not claim any extras or damages on these grounds.

b. So also, the quantities mentioned in the schedule of quantities are approximate and if actual quantities executed are less or more than the schedule, the contractor shall not claim any damages for the same.

c. The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the prices stated in the Schedule of quantities and/ or the Schedule of Rates and prices which rates and prices shall over all his obligations under the Contract, and all matters and things necessary for the proper completion of the works.

d. The Consulting Architect may from time to time intimate to the Contractor that he requires the works to be measured and the Contractor shall forthwith attend or send a qualified Agent to assist the Architect or the Architect's representative in taking such measurements and Calculations and to furnish all particulars including the shop drawings, give all assistance required by either of them. Should the Contractor not attend or neglect or omit to send such Agent then the measurements taken by the consulting Architect or approved by him shall be taken to be the correct measurements of the works. Such measurements shall be taken in accordance with the Standard method of Measurement of building works last before issued by the Indian Institute of Architects. The Contractor or his Agent may at the time of measurement take such notes and measurement as he may require.

e. Should it be found after the completion of the works from measurements taken (in accordance with the previous paragraph) that any of the quantities or amounts of works thus ascertained are less or greater than the quantities or amounts specified for the works in the priced schedule of quantities and/or Tender or that any variation is made, the valuation of such quantities amount or variations, unless previously or otherwise agreed upon, shall be made in accordance with the following rules:

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

   ii. The net prices of the original Tender shall determine the value of the items omitted Provided if omissions may vary the conditions under which any remaining items of work are carried out the prices for the same shall be valued under (iii) hereof:

   iii. Where extra work cannot be properly measured or valued the Contractor shall be allowed day work prices schedule of quantities or, if not so stated, then in accordance with the local daily work rates and wages for the district; provided that in either case vouchers specifying the daily time (and if required by the consulting Architect the workmen's names) and materials employed be delivered for verification into the Architect or his representative at or before the end of the week following that in which the work has been executed. The measurement and valuation in respect of the Contract shall be completed within the Period of Final Measurements stated in the Appendix or if not so stated, then within 6 months of the Completion of the Contract works as defined in Clause 4.f here of.

f. Where in any certificate of which the Contractor has received payment) the Consulting Architect has included the value of any unfixed materials intended for and/or placed on or adjacent to the works such materials shall become the property of the Employer and they shall not be removed except for use upon

the works without the written authority of the Architect. The contractor shall be liable for any loss or damage to such materials.

5. Material to be supplied by the contractor.

a. The contractor shall procure and provide the whole of the materials required for the Construction including tools, tackles, construction plant and equipment for the completion and maintenance of the work except the materials which will be supplied by the owner and shall make his own arrangements for procuring such materials and for the transport / storage thereof. The owner will insist on the procurement of all materials confirming to IS or relevance standard and from reputed suppliers. Samples where applicable shall be got approved from Architects. All equipment marks to be got approved prior to the procurement.

b. All materials procured should meet the specifications given in the tender document. The Architects may at his discretion ask for samples and test certificate of any batch of any material procured. Before procuring, the contractor should get the approval of Architect for any material to be used for the works in addition to batch certification by the manufacturer)

c. Manufacture's certificate shall be submitted for all materials supplied by the Contractor. As directed by Architect, any material which is procured by the contractor shall have to get tested either in the site laboratory or in any outside laboratory approved by Architect at the cost of the contractor.

d. Contractor shall furnish him with all invoices, accounts, receipts, and other vouchers to prove that the materials comply therewith.

e. The transportation of material up to site, unloading, storage, testing, inter site transport, handling rehandling, lifting, shifting, protecting, protecting, watch and ward, Insurance till completion, reconciliation etc. or any other such act required shall not be paid for separately and contractor's item rates shall be deemed to be inclusive of all such charges.

f. Cement.

i. Cement for construction, Unloading, Counting, weighing, transporting, testing, storing, security watch and ward, lifting, shifting, handling, re handling, insurance shall be Contractor's responsibility. Contractor shall construct temporary cement Godown at locations approved by Architect/ PMC at his own cost and risk. These temporary Godowns shall be dismantled after completion of work and site of these. Godown shall be levelled and cleaned to the satisfaction of Architect/ PMC.

ii. Contractor shall submit daily cement consumption statement to Architect / COW in the format approved by Architect / COW. Architect / COW may carry out physical verification of balance stock each week.

iii. Contractor shall store the cement strictly as specified in the standard specifications of PWD. Any loss or damage due to any reason whatsoever, shall be recovered from the contractor.

iv. The contractor shall maintain the record of actual weight of cement received. The reCounciliation statement shall be prepared based upon the actual cement received on site.

v. Contractor shall carry out all testing of the cement at his own cost.

6. Contract Drawings:-

a. In general the drawings shall indicate dimensions, positions and type of construction, the specifications shall indicate the quality and the methods; and the bill of quantities shall indicate the quantum and the rate of each item of work. Any work indicated on the drawings and not mentioned in the specifications or vice versa shall be furnished as though fully set forth in both. Work not specifically detailed, called for, marked and specified shall be the same as similar parts that are detailed, marked and specified.

b. The contractor's work shall not deviate from the drawings and the specifications. The Architect's interpretation of these documents shall be final.

c. Errors or inconsistencies discovered in the drawings and specifications shall be promptly brought to the notice of the Architects for interpretation of correction. Local conditions which may affect the work shall likewise be brought to the architect's attention, if at any time, it is discovered that work is being done which is not in accordance with the Contract drawings and specifications, the contractor shall correct the work immediately. Corrections of defective work shall not bias for any claim for extension of time.

d. Figured dimensions on the scale drawings and large size details shall govern. Large size details take precedence over small scale drawings, any work done before receipt of such details, if not accordance with the same, shall be removed and replaced or adjusted, as directed, by the contractor without expenses to the owner. The general conditions apply with equal force to all the works including authorised extra works.

e. All drawings, bill of quantities and specifications and copies thereof furnished by the architect are his property. They shall not be used for any other work and shall be returned to the architect as his request on completion or termination of the contract.

f. Reinforcing bar bending schedules shall, if requested by the Architect, be furnished to the Architects at least fifteen days prior to the fabrication of the reinforcement.

7. Contract Sum

a. The contract sum shall not be adjusted or altered in any way whatsoever other than in accordance with express provisions of these conditions. Any error, whether of arithmetic or not, in computation of contract sum, shall be deemed to have been accepted by the parties hereto.

8. Running Account bills -

a. The contractor shall prepare running accounts bill at the interim period mentioned on the face sheet. The actual measurements shall be checked by the COW in presence of Site engineer and verified BOQ shall be sent to Architects' office for certification.

b. The quality and quantity of the work included in the contract sum shall be deemed to be that which is set out in the contract which bills unless expressly.

9. scope and Intent

a. Scope – The general character and scope of the work is illustrated and defined by the specifications and the bills of quantities herewith attached and by the signed drawings. If the contractor shall find any discrepancy in or divergence between the contract drawings, he shall immediately give to the Architect a written notice specifying the discrepancy and the architect shall issue instructions in regard thereto.

b. Extent: - the contractor shall carry out and complete the work in every respect in accordance with this contract and with the directions of and to the reasonable satisfaction of the Architect.

c. Intent: - the intention of the document is to include all labour and materials, equipment and transportation necessary for the proper execution of the work. Materials of the work described in words, which so applied, have a well known technical trade or meaning, shall be held to refer such recognized standard meaning.

10. Architects' instructions and decisions - The Contractor shall carry out and complete the said work in every respect in accordance with the directions of and to the satisfaction of the Architect. The Architect may in his absolute discretion and from time-to-time issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as Architect's instructions in regard to:

a. The variation or modification of the design, quality or quantity of works or the additions or omission or substitution of any work.

b. The removal from the site of any material brought thereon by the Contractor and the substitution of any other material, therefore.

c. Any discrepancy in the Drawings or between the Schedule of Quantities and /or specification.

d. The removal and / or re-execution of any works executed by the Contractor.

e. The dismissal from the works of any persons employed thereupon.

f. The opening up for inspection of any work covered up.

g. The amending and making good of any defects under Clause 22 & 42.

The Contractor shall forthwith comply with and duly executed any work comprised in such Consultant's Instructions provided always that verbal Instructions, directions and explanation given to the Contractor or his representative upon the works by the Consultant shall, if involving a variation, be confirmed in writing by the Contractor, within seven days, and if not dissented from in writing within a further seven days by the Consultant, such shall be deemed to be Consultant's Instructions within the scope of the Contract.

11. The Contractor shall provide everything necessary for the proper execution of the works according to the intent and meaning of the Drawings, schedule of Quantities and specification taken together where the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy in the Drawings or between he Drawings, Schedule or quantities and the Drawings or between the Drawings, schedule or Quantities and specification he shall immediately and in writing refer the same to the Architect who shall decide which is to be followed.

12. **Statutory Obligations, Notices, Fees and Charges -** The Contractor shall conform to the Provisions of any act of the Legislature relating to the works, and to the Regulations and Bye-laws of any Authority, and of any water, Lighting and other companies and/authorities with whose systems the structure is proposed to be connected and shall, before making any variations from the drawings or specifications that may be necessitated by so conforming, give to the Architect written notice, specifying the variation proposed to be made and the reason for making it, and apply for instructions thereon. In case the Contractor shall not within ten days receive such instructions, he shall proceed with the work, confirming to the provisions, Regulations, or Bye-laws in question, and any variation so necessitated shall be dealt with under Clause no 20. The Contractor shall bring to the attention of the Architect all notices required by the said Act, Regulations or Bye-laws to be given to any Authority and pay to such Authority, or to any public office all fees that may be properly chargeable in respect of the works, and lodge the receipts with the Architects.

The contractor shall pay and indemnify the owner against liability in respect of any fees or charges (including any rates and taxes) legally demandable under any act of Parliament, instrument, rule or order or any regulation or bye-law of any local authority in respect of the work.

13. **Setting out -** The Contractor shall set out the works 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. If any time any error in this respect shall appear during the progress of the works, the Contractor shall at his own expense rectify such error if so required to the satisfaction of the Architect.

14. The Contractor shall give all necessary personal supervision during the execution of the works, and as long thereafter as the Architect may consider necessary until the expiration of the Defects Liability Period Stated in the Appendix hereto. The Contractor shall also during the whole time the works are in progress employ a competent representative who shall be constantly in attendance at the building while the men are at work. Any directions, explanations, instructions or notices given by the Architect to such representative shall be held to be given to the Contractor.

15. The Contractor shall on the request of the Consulting Architect immediately dismiss from the works any person employed thereon by him, who may, in the opinion of the Architect, be incompetent or

misconducts himself, and such persons shall not be again employed on the works without the permission of the Architect.

16. **Access of Architects to the Site / Works -** The consulting Architect shall at all reasonable times have free access to the works and/ or to the workshops, factories, or other places where materials are lying or from which they are being obtained, and the Contractor shall give every facility to the Architect and his representative necessary for inspections and examination and test of the materials and workmanship. No person unauthorised by the Architect except the representatives of public Authorities shall be allowed on the works at any time.

17. The term **Clerk of Works** shall mean the person approved by the Consulting Architect and appointed and paid by the employer and acting under the orders of the consulting Architect to inspect the works in the absence of the Architect, the Contractor shall afford the Clerk of works every facility and assistance for inspecting the works and materials and for checking and measuring time and materials. Neither the Clerk of Works nor any representative of the Consulting Architect shall have power to set out works or to revoke, alter, enlarge or relax any requirements of the contract, or to sanction any day work, additions, alterations, deviations or omissions, or any extra work whatever except in so far as such authority may be specially conferred by a written order of the Consulting Architect. The Clerk of works, or representative of the consulting Architect, shall have power to give notice to the Contractor or to his representative of non-approval of any work or materials and such work shall be suspended or the use of such materials shall be discounted until the decision of the consulting Architect is obtained. The work will from time to time be examined by the Consulting Architect, the Clerk of works or the Consulting Architect's representative, 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 works of after the same is completed Subject to the limitations of this Clause the Contractor shall take instructions only from the Consulting Architect.

18. The whole of the works included in the Contract shall be executed by the contractor and the Contractor shall not directly or indirectly transfer, assign, or underlet the contract or any part or share thereof or interest therein, without the written consent of the Consulting Architect, and no undertaking shall relieve the Contractor from the full and entire responsibility of the Contractor or from active superintendence of the works during their progress.

19. No alteration, omission or variation shall vitiate this contract but in case the Consultant thinks proper at any time during the progress of the works to make any alterations in or additions to or omissions from the works or to be used therein and shall give notice thereof in writing under his hand to the Contractor the Contractor shall after, add to or omit from as the case may require in accordance with such notice but the contractor shall not do any work extra to or make any alteration or additions to or omissions from the works or any deviation for any Contract drawings without the previous consent in writing of the Architect and the value of such extra, alterations, additions or omissions shall in all cases be determined by the Architect in accordance with the provisions of Clause 4.e hereof, and the same shall be added to or deducted from the contract amount accordingly.

20. The Consulting Architect shall, during the progress of the works have power to order in writing from time to time the removal form the works within such reasonable time or times as may be specified in the order, of any materials which in the opinion of the Architect are not in accordance with the specification or the instructions or the Architect, the substitution of proper materials, and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the Drawings and specifications or instructions and the Contractor shall forthwith carry out such order at his own cost. In case of default on the part of the Contractor to carry out such order, the Employer shall have the power

to employ and pay other persons to carry out the same; and all expenses consequent thereon or incidental thereto as certified by the Architect shall be borne by the Employer from any moneys due or that may become due to the Contractor.

21. Any defect, shrinkage settlement or other faults which may appear within the defects liability period stated in the appendix hereto, or if none stated then within twenty four months after the virtual completion of the works, arising in the opinion of the Architect from materials or workmanship not in accordance with the contract shall upon the directions in writing of the Architect, and within such reasonable time as shall be specified therein, be amended and made good by the Contractor at his own cost unless the Architect shall decide that he ought to be paid for such amending and making good and in case of default, the Employer may employ and pay other persons to amend and make good such defects, shrinkage, settlements or other defaults, and all thereto shall be made good and borne by the Contractor and such damage loss and expenses shall be recoverable from him by the employer or may be deducted by the employer upon the Architect's certificate in writing from any money due or that may become due to the Contractor or the Employer may in lieu of such amending and making good by the Contractor deduct from any money due to the contractor a sum to be determined by the Architect equivalent to the cost of amending such work and in the event of the amount retained under clause 35 being insufficient recover the balance from the Contractor, together with any expenses the client may have incurred in connection therewith, should any defective work have been done or material supplied by the Sub Contractor employed on the works who has been nominated or approved by the Architect as provided in Clauses 11 and 24 the Contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the Contractor and been subject to the provisions of this Clause and the Clause 2 hereof. The contractor shall remain liable under the provisions of this clause notwithstanding the signing by the Architect of any certificate or the passing of any accounts.

22. The works shall not be considered as completed until the consultant has certified in writing that they have been virtually completed and the Defects liability period shall commence from the date of such Certificate.

23. **Sub-contractors –** as soon as practicable and before awarding any sub-contract, the contractor shall notify the Architect in writing the names of the sub-contractor for the proposed principal parts of the work and for such other parts as the Architects any direct and shall not employ to whom Architect or the owner may have a reasonable objection.

The Architect, however, shall have power to obtain estimate and select other agencies to carry out any of the work as described below.

a. All specialists, Merchants, Tradesmen and other executing any work or supplying and fixing any goods for which price cost prices or provisional sums are included in the Schedule of quantities and/or specification whom may be nominated or selected by the Architect are hereby declared to be sub-contractors employed by the Contractors and are herein referred to as nominated subcontractors. No nominated sub-contractor shall be employed or in connection with the work against whom the contractor shall make reasonable objection or (save where the Architect and contractor shall otherwise agree) who will not enter contract providing.

   i. That the nominated sub-contractor shall carry out and complete the sub-contract works in every respect to the reasonable satisfaction of the contractor and of the architect and in conformity with all the reasonable directions and requirements of the contractor.

   ii. That the nominated sub-contractor shall observe, perform, and comply with all the provisions of the contract on the per of the contractor to be observed, performed, and complied with (other

than clause 43 of these conditions, if applicable) so far as they relate and apply to the sub-contract works or to any portion of the same.

iii. That the nominated sub-contractor shall indemnify the contractor against the same liabilities in respect of the sub-contract work, as those for which the contactor is liable to indemnify the owner under this contract.

iv. That the nominated sub-contractor shall indemnify the contractor against claims in respect of any negligence, omission or default of such contractor, his servents or agents or any misuse by him or them of any scaffolding or other plant and shall insure himself against any such claims and produce the policy, or policies and premium receipts as and when required by the contractor or Architect.

v. That the payment in respect of any work, materials or goods comprised in the sub-contract shall be made within fourteen days after receipt by the contractor of the Architect's certificate under clause 35 of these conditions which states as due an amount calculated by including the total value of such work, materials or good, and shall when due be subject to the retention by contractor of the sums mentioned in sub-paragraph (ix)

vi. That the architects and his representatives shall have right of access to the workshops and other places of the nominated sub-contractor as mentioned in clause 17 of these conditions.

vii. That the sub-contract work shall be completed within the period or (where those are to be completed in sections) period therein specified, that the contractor shall not, without the written consent to the Architect, grant ant extension of time for the completion of the sub-contract work or any section thereof, and that the contractor shall inform the architect of any representative made by the nominated sub-contractor as to the cause of any delay in the progress of completion of this sub-contract work or any section thereof.

viii. That if the nominated sub-contractor shall fail to complete the sub-contract work of (where the sub-contract works are to be completed in sections) any section thereof within the period therein specified or within any extended time granted by the contractor with the written consent of the Architect, and the architect certifies in writing to the contractor that the same ought reasonably so to have been completed, the nominated sub-contractor shall pay or allow to the contractor wither a sum calculated at the rate agreed therein as Liquidated or Ascertained Damage, for the period during which the said work or any section thereof, as the case may be, shall so remain or have remained incomplete or (where no such rate is therein agreed) a sum equivalent to any loss or damage suffered or incurred by the contractor and caused by the failure of the nominated sub-contractor as aforesaid.

ix. That the contractor shall retain from the sum directed by the architect having been included in the calculation of the amount stated as due in any certificate issued under clause 35 of these conditions in respect of the total value of the work, material or goods, executed or supplied by the nominated sub-contractor, the percentage of such value named in Appendix to these conditions as percentage of certified value retained upto a total amount not exceeding a sum which bears the same ratio to the sub-contract price as the unreduced sum named in the appendix to these conditions as limited retention fund bears to the contract sum; and that the contractor's interest in any such sums so retained (by whomsoever held) shall be fiduciary as trustee for the nominated sub-contractor's beneficial interest in such sums shall be subject only to the right of the contractor to have recourse thereto from time to time for payment of any amount, which he is entitled under the sub-contract to deduct from any sum due or to become due to the nominated

sub-contractor, and that if and when such sums or any part thereof are released to the nominated sub-contractor, those shall be paid in full, if paid within 14 days of the date fixed for their release in the sub-contract.

b. Before issuing any certificate under clause 35 of these conditions, the architect may request the contractor to furnish him with reasonable proof that all amounts included in the calculation of the amount stated due as on previous certificates in respect of the total value of the work, material or goods, executed or supplied by the nominated sub-contractor, have been duly discharged and if the contractor fails to comply with any such request, the architect shall issue a certificate to that effect and thereupon the owner may himself pay such amount to any nominated sub-contractor concerned and deduct the same from any sum due or become due to the contractor.

c. Extension of work

i. The contractor shall not grant to any nominated sub-contractor any extension of the period within which the sub-contract works or (where the sub-contract work is completed in sections) any section thereof is to be completed without written consent of the Architect, provided always that the contractor shall inform Architect of any representation made by the nominated sub-contractor as to the cause of any delay in the progress or completion of the sub-contract work or any section thereof and that the consent of the Architect shall not be unreasonably withheld.

ii. If any nominated sub-contractor fails to complete work or (where the sub-contract work is completed in sections) any section thereof within the period specified in the sub-contract or within the extended time granted by the contractor with the written consent if the architect, then if the same out reasonable so to have been completed the architect shall certify in writing accordingly. Any such certificate shall be issued to the contractor and immediately upon issue the architect/ PMC shall send a duplicate copy thereof to the nominated sub-contractor.

d. If the Architect desires to secure final payment of any nominated sub-contractor before final payment is due to contractor, and if such contractor has satisfactorily indemnified the contractor against latent defects, then the Architect may in an interim certificate include, an amount to cover the said final payment and thereupon the contractor shall pay such nominated sub-contractor the amount so certified. Upon such final payment, the amount named in the appendix to these conditions as limit of retention fund shall be reduced by the sum which bears the same ratio to the said amount as does such sub-contractor's sub-contract price to the contract sum, and save for the latent defects. The contractor shall be discharged from all liability for the works, material or goods, executed or supplied by the nominated sub-contractor under the sub-contract to which the payment relates.

e. Neither the existence nor the exercise of the foregoing powers nor anything else contained in these conditions shall render the owner in any way liable to any nominated sub-contractor.

f. Where the contractor in ordinary course of his business directly carried out works for which prime costs or provisional sums are included in the contract bills and the Architect is prepared to receive tenders form the contractors for such items, then the contractor shall be permitted to tender for the same or any of them but without prejudice to the owner's right to reject the lowest or any tender. If the contractor's tender is accepted, he shall not sub-let the work without the consent in writing of the Architect.

g. It shall be a condition of any tender accepted under this paragraph that clause 52 of these conditions shall apply in respect of the item work included in the tender as if for the reference therein to the contract drawings and the contract bills there were references to the equivalent documents included or referred to in the tender.

h. The contractor shall allow for general attendance upon sub-contractor s including free use of plant scaffolding and is to allow them the use of sanitary conveniences, storage facilities for storing material, other amenities and affording them all reasonable facilities for carrying out the contract.

24. Opportunities for other Contractors The Contractor shall, in accordance with the requirements of the Consultant, afford all reasonable opportunities for carrying out their work to any other Contractors employed by the employer and their workmen and to the workmen of the employer and of any other duly constituted authorities who may be employed in the execution on or near the site of any work not included in the Contract or of any connection with or ancillary to the works. Except where otherwise provided by the contract, the Contractor shall make available to any such other contractor or to the employer or any such authority permit the use by any such of the Contractors scaffolding or other plant on the site or labour including the Supervision thereof), transport to or from the site and in and about the Works or provide any other service of whatsoever nature required for the construction, completion and maintenance of the works.

The Contractor shall do all cutting, filling, or patching of his work that may be required to make its several parts come together properly and fit it to receive or to be received by work of other contractors shown upon or reasonably implied by the drawings and specifications and he shall make good after them as the consultant may direct. Any cost caused by the defective or ill-timed work shall be borne by the party responsible, therefore.

The Contractor shall not endanger any work by cutting; excavating or otherwise altering the work of any other contractors have with the consent of the consultant.

25. The employer with the concurrence of the Architect reserves the right to use the premises and any portions of the site for the execution of any work not included in this contract which he may desire to have carried out by other persons, and the Contractor is to allow all reasonable facilities for the execution of such work, but is not required to provide any plant or materials for the execution of such except by special arrangement with the Employer, such work shall be carried out in such manner as not to impede the progress of the works included in the contract and the contractor is not responsible for any damage or delay which major happen to or be occasioned by such work.

26. Contractor's responsibility for security

a. The Contractor shall be responsible for all injury to persons, animals, or things and all structural and decorative damage to property which may arise from the operation or neglect of himself or of any nominated sub-contractor's employee, whether such injury or damage arise from carelessness, accident, or any other cause whatever in any way connected with the carrying out of this contract. This Clause shall be held to include, inter alia, any damage to buildings, whether immediately adjacent or otherwise, and any damage to roads, streets, foot paths bridges or ways as well as all damage caused to the Buildings and Works forming the subject of this contract by frost or other inclemency of weather.

b. The Contractor shall indemnify the Employer and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any award of compensation or damage consequent upon such claim. The contractor shall, reinstate all damage of every sort mentioned in this Clause, so as to deliver up the whole of the Contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of third parties. The Contractor shall indemnify the Employer against all claims which may be made against the employer by any member of the public or other third party in respect of anything which may arise in respect of the works or in consequence hereof and shall at his own expense arrange to effect and maintain, until the virtual completion of the contract, with an approved policy of Insurance in the joint names of the employer and the Contractor against such risks and deposit such policy or policies with the Consultant from time

to time during the currency of this Contract. The Contractor shall similarly indemnify the employer against all claims, which may be made upon the employer whether under the Workmen's compensation Act or any other statute in force during the currency of this Contract, or at common law in respect of any employee of the Contractor or any sub-contractor and shall at his own expense effect and maintain until virtual completion a policy of Insurance in the joint names of the Employer and the Contractor against such risks and deposit such policy or policies with the Architect from time to time during the currency of the Contract.

c. The Contractor shall be responsible for anything, which may be excluded from the Insurance Policies above referred to, and also for all other damages to any property arising out of and incidental to the negligence or defective carrying out of his contract. He shall also indemnify the Employer in respect of any costs, charges or expenses arising out of any claim or proceeding and also in respect of any Award of or compensation of damage arising the reform.

d. The Employer with the concurrence of the Consultant shall be at liberty and is hereby empowered to deduct the amount of any damage compensation, costs charges and expenses, arising or occurring from or in respect of any claim or damage from any sum or sums due or to the Contractor.

27. Insurance –

a. The Contractor shall at the time of signing the Contract insure the works and keep them insured until the virtual completion of the Contract against loss or damage by fire in an office to be approved by the Consultant, in the joint names of the Employer and Contractor (the name of the former being placed first in the policy) for the full amount to the Contract and for any further sum if called upon to do so by the Architect, the premium of such further sum being allowed to the Contractor, as an authorised extra such Policy shall cover the property of the Employer only, fees for assessing the claim and in connection with his services generally therein, and shall not cover any property of the Contractor or of any sub Contractor or employee. The Contractor shall deposit the policy and receipt for the premiums with the Architect within twenty one days from the date of signing the Contract unless otherwise instructed by the Architect. In default of the Contractor insuring as provided above the Employer can deduct the same from any money due or which may become due to the contractor. The contractor shall as soon as the claim under the Policy is settled, or the work reinstated by the insurance office, should they elect to do so, proceed with all due diligence with the completion of the works in the respect under the same conditions of contract. The Contractor, in case of rebuilding or reinstatement after fire, shall be entitled to such extension of time for completion as the Architect deems fit.

Provided always that if the contractor shall independently of his obligation under this contract maintain a policy of insurance which covers (inter alia) the said work, materials and goods against the aforesaid contingencies to the full value thereof then the maintenance by the contractor of such policy shall, if the owner's interest is endorsed thereon, be a discharge of contractor's obligation to insure in the joint names of the owner and contractor and the production by the contractor as and when may reasonably be required by the Architect of a current certificate of insurance from the company or firm which shall have issued the said policy shall be a discharge of the contractor's obligation to deposit with the Architect a policy or policies and receipts in respect of premium paid.

i. Upon settlement of any claim under the insurance's aforesaid, the contractor with due diligence shall restore work damaged, replace or repair unfixed materials or goods which have been destroyed or injured, removed or disposed of any debris and proceed with the carrying out and completion of work. All monies received from such insurance's shall be paid to contractor by

instalments under certificates to the Architects, issued at the period of interim certificates named in the appendix to these conditions. The contractor shall not be entitled to payment in respect of restoration of work damaged, the replacement and repair of any unfixed materials or gods and removal and the disposal of debris other than monies received under the said insurances.

Clause 28.a shall be applicable to the erection of a new building if the contractor is required to insure against loss or damage by fire, etc.

b. All work executed and all unfixed materials and goods intended for, delivered to and placed on or adjacent to the works (except temporary buildings, plants, tools and equipment's owned and hired by the contractor or any sub-contractor) shall be at sole risk of the owner as regards loss and damage by fire, storm, tempest, lightening, flood, earthquake, aircraft or anything dropped there from, arial object, riot or civil commotion. If any loss or damage affecting the work or any part thereof or any such unfixed materials or goods is occasioned by any one or more of the said contingencies, then.

i. The occurrence of such loss or damage shall be disregarded in computing any amounts payable to the contractor under virtue of this contract.

ii. The contractor with due diligence shall restore work damaged, replace, or repair unfixed materials or goods which have been destroyed or injured, removed or disposed of any debris and proceed with the carrying out and completion of work. The restoration work damaged the replacement and repair of unfixed materials and goods and the removal and disposal of debris shall be deemed to be a variation required by the Architect.

Clause 28.b is applicable to erection of a new building if the owner is to bear the risk in respect to loss or damage by fire etc.

c. The existing structure together with all the contents thereof and the works and all unfixed materials and goods intended for, delivered to and placed on or adjacent to the works (except temporary buildings, plants, tools and equipments owned or hired by the contractor or any other sub-contractor shall be at his own risk as regards loss and damage by fire, storm, tempest, lightening, flood, earthquake, aircraft or anything dropped there from, arial object, riot or civil commotion and the owner shall maintain adequate insurance against risk if any loss or damage affecting the work or any other part thereof or any such unfixed material of goods is occasioned by anyone or more of the same contingencies the,

i. The occurrence of such loss or damage shall be disregarded in computing any amounts payable to the contractor under or by virtue of this contract.

ii. Notice of determination

1. if it id just and equitable so to do the employment of the contractor under this contract may within 28 days of the occurrence of such loss or damage be determined at the option of either party by notice, by registered post or recorded delivery from either party to the other. Within seven days of receiving such notice (but not thereafter) either party may give to the other a written request to concur in the appointment of an arbitrator under clause 53 of these conditions in order that it may be determined whether such determination will be just and equitable.
2. Upon giving or receiving by the owner of such a notice of determination or whether a reference of arbitration is as aforesaid upon the arbitrator upholding the notice of determination of provision of sub0clause (b) (Except paragraph 3) of these conditions shall apply.
3. If no notice of determination is served as aforesaid or where reference to arbitration is made as aforesaid, if the arbitrator decides against the notice of determination then.

a. The contractor with due diligence shall reinstate or make good such loss or damage and proceed with the carrying out and completion of the works.
b. The architect may issue instructions requiring contractor to remove and dispose off any debris ; and
c. The reinstatement and making good of such loss or damage and (when required) the removal and disposal of debris shall be deemed to have a variation required by the architect

28. Remedy on Contractor's failure to insure: If within a reasonable time from the commencement of the works the contractor shall fail to effect and keep in force the insurance previously referred to and any other insurances which he may be required to effect under the terms of the contract, then the Contractor shall be responsible for the consequences of such a default. In any case the Employer may effect and keep in force any such insurance and pay such premium as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any monies due or which may become due to the Contractor or recover the same as a debt due from the Contractor.

29. The Contractor shall be allowed admittance to the site on the Date of commencement stated in the Appendix, and he shall thereupon and forthwith begin the works and shall regularly proceed with the work and the complete the same (except such painting or other decorative work as the Architect may desire to delay) on or before the Day of Completion stated in the Appendix subject nevertheless to the provisions for extension of time herein contained. **The work shall in no way delayed or stopped by the contractor on account of any dispute between him and his nominated / other subcontractor**

30. If the Contractor fails to complete the works by the date stated in the appendix or within any extended time under clause 32 hereof and the Consulting Architect's Certificate in writing that in his opinion the same ought reasonably so to have been completed the Contractor shall pay or allow to the Employer the such named in the appendix as Liquidated Damages for the period during which the said works shall so remain incomplete and the employer may deduct such damages from any moneys due to the Contractor.

31. If in the opinion of the Consulting Architect the works be delayed,

a. By force major or
b. By reason of any exceptionally inclement weather, natural calamity or
c. By reason of proceedings taken or threatened by or dispute adjoining or neighbouring owners or Public authorities arising otherwise than though the Contractor's own default or
d. By the works or delays of other contractors or Tradesmen engaged or nominated by the Client or the Architect and not referred to in the Schedule of Quantities and/or specification or
e. By reason of Consulting Architect's Instructions as per Clause 11 or
f. In consequence of the Contractor not having received in due time necessary instructions from the Consultant for which Shall have specifically applied in writing,
g. By reason of civil commotion, local combination of workmen strike or lockout affecting any of the trades employed upon the works or any of the trades engaged in the preparation, manufacture, or transportation of any of the goods or materials required for the work, or
h. By delay on the part of nominated sub-contractors or nominated suppliers which the contractor has taken all practicable steps to avoid or reduce or
i. By delay on the part of artists, tradesmen or others engaged by the owner in executing work not forming part of this contract.
j. By reason of the opening for inspection of any work covered up or of the testing of any of the testing of any of the work, materials or goods in accordance with clause 21 of these conditions (including making goods in consequence of such opening up or testing unless the inspection of test showed that the work materials or goods were not in accordance with this contract, or

k. By reason of the contractor's inability for reason beyond his control and which he could not reasonably have foreseen at the date of this contract to secure such labor goods or materials as are essential to the proper carrying out of the works.

The Consultant shall make a fair and reasonable extension of time for completion of the Contract works, in case of such strike lock-out the Contractor shall, as soon as may be, give written notice thereof to the consulting Architect, but the Contractor shall nevertheless constantly use his endeavours to prevent delay and shall do all that may reasonably be required, to the satisfaction of the Architect and/or Consulting Engineer, to proceed with the work.

32. If the Contractor after receipt of written from the Consultant requiring compliance within ten days, fails to comply with further drawings and/or Architect's/Consulting Engineer's Instructions the employer with the consent of the Architect may employ and pay other persons to execute any such work whatsoever as may be necessary to give effect thereto, and all costs, incurred in connection therewith shall be recoverable from the Contractor by the employer on the certificate of Architect/consulting Engineer as a debt or may be deducted from any moneys due to become to the Contractor.

33. If the Contractor being an individual or a firm commit any Act of the Insolvency or shall be adjudged an Insolvent or being an incorporated Company shall have an order for compulsory winding up voluntarily or subject to the supervision of the court and of the official assignee for the Liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him requiring him to do, so to show to the reasonable satisfaction of the Architect that he is able to carry out and fulfil the contract and to give security therefore, if so required by the Architect / Consulting Engineer

a. Or, if the Contractor (whether an individual, firm or incorporated Company) shall suffer execution to be issued.
b. Or shall suffer any payment under this Contract to be attached or on behalf of any of the creditors of the Contractor.
c. Or shall assign or sublet the contract without the consent in writing of the Consultant obtained first.
d. Or shall charge or encumber this Contract or any payments due to or which may become due to the Contractor there-under.
e. Or if the Consulting Architect shall certify in writing to the Employer that the Contractor.
    i. Has abandoned the contract, or
    ii. Has failed to commence the works, or has without any lawful excuse under these conditions, suspended the progress of the works for 14 days after receiving from the Architect/Consulting Engineer, written notice to proceed. Or
    iii. Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon or
    iv. Has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Architect/ consulting Engineer, written notice that the said materials or work were condemned & rejected by the Architect under these conditions, or
    v. 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 requiring the Contractor to observe or perform the same or
    vi. Has to the detriment of good workmanship or in the defiance of the Architect's Instructions to the contrary sub-let any part of the contract.

Then, and in any of the said cause, the Employer with the written consent of the Architect, may notwithstanding any previous waiver after giving seven days' notice in writing to the Contractor, determine

the Contract, but without thereby affecting the power of the Architect or the obligations 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 executed had been executed by or on behalf of the Contractor. And further, the Employer under instructions of the Architect, by his agents or servant may enter upon and take possession of the works and all plant tools, scaffoldings, laying upon the premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the works or by employing any other Contractors or other person or persons to complete the works, and the Contractors shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other Contractor or other person employed for the works, when the works shall be completed or as soon as thereafter as convenient, the Architect shall give a notice in writing to the Contractor to remove his surplus materials and plant and should the contractor fail to do so within 14 days after receipt thereof by him, the Employer shall sell the same by public auction and shall give the credit to the Contractor for the amount realised. The Architect shall thereafter ascertain and certify payable to or by the Employer for the value of the said plant and materials so taken possession of by the employer and the expense or loss which the employer shall have been put to in procuring the works to be completed, and the amount if any, owing to the Contractor and the amount which shall be certified shall thereupon be paid by the employer to the Contractor or by the Contractor to the Employer, as the case may be, and the Certificate of the Architect/ Consulting engineer shall be final conclusive between the parties. Certificate of the Architect/Consulting Engineer with interest provided for hereinafter, shall be in arrears and unpaid for thirty days after notice in writing requiring payment of the amount with interest as aforesaid shall have been given by the Contractor to the Employer or if the employer interferes with or obstructs the issue of any such Certificate, or the employer commits any act of insolvency or if the Employer (being an individual, or firm) shall be adjudged an Insolvent, or (being incorporated Company) shall have an order made against him or pass an effective Resolution for winding up, either compulsory or subject to the supervision of the Court or Voluntarily or if the official Assignee or the Liquidator in any such winding up shall be unable within fifteen days after notice to him requiring him to do to show the reasonable satisfaction of the contractor that he is able to carry out and fulfil the Contract and to make Contractor, to give security of the same or if the works be stopped for all payments due and to become due hereunder and, if required by three months under the order of Architect of the employer by any injunction or other order of any Court of Law, then and in any of the said Cases, the Contractor shall be at liberty to determine the Contract by notice in writing to the Employer through the consulting engineer/ architect, and he shall be entitled to recover from the employer, payment for all works executed and for any loss he may sustain upon any plant or materials supplied or purchased or prepared for the purpose of the contract.

In arriving at the amount of such payment the net rates contained in the Contractor's original Tender shall be followed, or where the same may not apply valuation shall be made in accordance with clause 4.c hereof.

34. Certificate and Payment.

a. At the period of Interim Certificate named in the appendix to these conditions the architect shall issue a certificate stating the amount due to the contractor from the owner, and the contractor be entitled to payment therefore within the period for honouring certificates named in the appendix to these conditions, interim valuations shall be made whenever the architect considers them to be necessary for the purpose of ascertaining the amount to be stated as due in an interim Certificate.

b. The amount, stated as due in an Interim Certificate, shall subject to any agreement between the parties as to stage payments, be the total value of the work properly executed and of the materials and goods delivered to, or adjacent to the work for use thereon upto and including a date not more than seven days before the date of the said certificate, less any amount which may be retained by the owner (as provided in sub-clause(c) of this condition) and less any instalments previously paid under this condition, provided that such certificate shall only include the value of the said materials and goods as and from such time as those are reasonably, properly and not prematurely brought to or placed adjacent to the work and the only if adequately protected against weather or other casualties.

c. The owner may retain the percentage of the total value of the work, materials and goods referred to in sub-clause (b) of this condition, which is named in the appendix to these conditions as retention percentage. Provided always, that when the sum of the amounts so retained equals the amount named in the said appendix as limit of retention fund no further amounts shall be retained by virtue of this sub-clause.

d. The amounts retained by virtue of sub-clause (c) of this condition shall be subject to the following rules:

   i. The owner's interest in any amounts so retained shall be fiduciary as trustee for the contractor (but without obligation to invest), and the contractor's beneficial interest therein shall be subject only to the right of the owner to have recourse thereto, from time to time, for payment of any amount to which he is entitled under the provisions of this contract to deduct from any sum due or to become due to the contractor.

   ii. On the issue of the certificate of virtual completion, the architect shall issue a certificate for one moiety, of the total amounts then so retained and the contractors shall be entitled to payment of the said moiety within the period for honouring the certificate named in the appendix to these conditions.

e. Measurement and valuation of works: -

   i. The measurement and valuation of the work shall be completed within the period of final measurement and valuation stated in the appendix to these conditions, and the contractor shall be supplied with a copy of the priced bills of variation not later than the end of the said period and before the issue of the final certificate under sub-clause (f) of this condition.

   ii. Either before or within a reasonable time after virtual completion of the work, the contractor shall send to the architect all documents necessary for the purposes of the computations, required by these conditions, including all documents relating to the accounts of nominated sub-contractors and nominated suppliers.

   iii. In the settlement of accounts, the amounts paid or payable under the appropriate contracts by the contractor to nominated sub-contractors or nominated suppliers, the amounts paid or payable by virtue of clause 13 of these conditions in respect of fees or charges for which a provisional sum is included in the contract bills, the amounts paid or payable in respect of any insurance maintained in compliance with clause 28 and 29, of these conditions, the tender sum (or such other sum as is appropriate in accordance with the terms of the tender) for any work for which a tender made under clause 24.f of these conditions is accepted and the value of any work executed by the contractor for which a provisional sum mentioned in the contract bill or arising under architect's /PMC's instructions issued under clause 51.c of these conditions as the case may be , and the balance, after allowing in all cases prorate for the contractor's profit at the rates shown in the contract bills, shall be added to or deducted form the contract sum. Provided that no deduction shall be made in respect of any damage paid or allowed to the contractor by any sub-contractor or supplier.

f. So soon as is practicable, but before the expiry of the period the length of which is stated in the appendix to these conditions from the end of the defects liability period also stated in the said appendix or from completion of making good defects under clause 22 & 42 of these conditions or from receipt by the architect/ PMC of the documents referred to in paragraph (ii) of sub-clause (e) of this condition, whichever is the latest, the architect/PMC shall issue the final certificate. The final certificate shall state;

i. The sum of the amount paid to the contractor under interim certificate and the amount named in the said appendix as limit of retention fund, and,

ii. The contract sum adjusted as necessary in accordance with the terms of these conditions, and the difference (if any between the two sums shall be expressed in the said certificate as a balance, due to the contractor from the owner or to the owner form the contractor as the case may be, and subject to any deductions authorized by these conditions; the said balance shall, as from the fourteenth day after the issue of the said certificate be a debt payable as the case may be by the owner to the contractor or by the contractor the owner.

g. Unless a written request to concur, in the appointment of an arbitrator shall have been given under clause 53 of these conditions by either party before the final certificate has been issued or by the contractor within 28 days after such issue. The said certificate shall be conclusive evidence in any proceedings arising out of this contract (whether by arbitration under clause 53 of these conditions or otherwise) that the works have been properly carried out and completed in accordance with the terms of this contract and that any necessary effect has been given to all the terms of this contract which require an adjustment to be made to the contract sum, except and in so far as any sum mentioned in the said certificate is erroneous by reason of;

i. Fraud, dishonesty or fraudulent concealment relating to the works, or any part hereof, or to nay matter dealt with in the said certificate; or

ii. Any defect (including any omission) in the works, or any part thereof which reasonable inspection or examination at any reasonable time during the carrying out of the works or before the issue of the said certificate would not have disclosed; or

iii. Any accidental inclusion or exclusion of any work, materials, goods or figure in any computation or any arithmetical error in any computation.

h. Save as aforesaid no certificate of the architect/PMC shall of itself be conclusive evidence that any works materials or goods to which it relates are in accordance with contract.

i. The Architect/ PMC may withhold or, on account of subsequently discovered evidence, nullify the hole or part of any certificate to such extent as may be necessary in this reasonable opinion to protect the owner form loss on account of Defective work not remedied.

i. Failure of the contractor to make payments properly to sub contractor or for material or for labour.

ii. A reasonable doubt that the Contract can be completed for the balance then unpaid.

iii. Damage to another contractor or sub-contractor.

iv. Claims filed on reasonable evidence indicating probable filing if claims.

When the above grounds are removed the payments shall be made for the amounts with held because of them.

35. Claim for Extra

a. When any instruction or decisions given at site involve an extra or whereby the contractor may plan to claim an extra, it shall be the responsibility of the contractor to inform the architect/PMC of the extra amount and get written authorization from the architect/ PMC before proceeding with the work involved.

b. Any modification carried out for expedition or simplifying work at the request of the contractor or his representatives shall not be taken as the basis for claiming an extra. However, if such modification shall also involve an extra, the rate for such modification shall be settled in advance and written authorization obtained by contractor form the architect/PMC before proceeding with the work involved. If the

contractor in writing gives no such information to the architect/PMC such modification shall not be accepted as the basis for extra charge.

36. **Extra Item -** The rate of Extra Items shall be worked out in accordance with the following rules-
    a. The rates for the extra items shall be derived from the rate of an appropriate item of the similar class for which the rate has already been accepted, where same can be directly derived.
    b. If the Extra Item is included in the State Schedule Of Rates for PWD, Govt. Of Maharashtra, same shall be adopted.
    c. Where the rates can not be worked out by the method given above, the Contractor shall be allowed the market rates for the materials and labour as applicable to the area plus 10% Profits and overheads provided the voucher for the materials supported by authorized dealers are delivered for the verification of the Architect / PMC or his representative within a week after the purchase for the same and that the daily time sheets for the labour are verified at the time of the execution of the work form the PMC or his representative and later presented along with the bill.
37. **Deduction for uncorrected work -** If the Architect / PMC deems it inexpedient to correct work damaged or not done in accordance with the contract price shall be made therefore.
38. **Fluctuations: -** The contractor shall not claim any extras for fluctuation of price and the contract price shall not be subject to any rise or fall of prices.
39. **Unfixed Goods and Materials -** Unfixed materials and goods intended for, delivered to and placed on or adjacent to the work shall not be removed except for use upon the work unless the architect/ PMC has consented in writing to such removal which consent shall not be unreasonable withheld. Where the value of any such materials or goods has in accordance with clause 35.b of these conditions been included in any interim certificate under the contract for which the contractor has received payment, such materials and goods shall become the property of the owner, but subject to clause 28. (b) of these conditions (if applicable) the contractor shall remain responsible for loss or damage to the same.
40. **Materials and Workmanship**
    a. All materials and workmanship shall be as per the relevant code of ISI specification and of approved type and the contractor shall immediately remove from the works any material and /or workmanship which in the opinion of the architect/PMC are defective or unsuitable and shall substitute proper materials and /or workmanship at his own cost. The term approval used in connection with this contract shall mean the approval of the architect/PMC.
    b. The contractor shall if required submit satisfactory evidence as to the kind and quality of material.
    c. Where special makes or brands are called for, they are mentioned as a standard. Others of equal quality may be used provided approval is first obtained in writing from the architect/PMC. Unless substitutions are requested no deviation from the specification will be permitted. Failure to purpose the substitution of any article within 30 days after singing of the contract will be deemed sufficient cause for denial of the request for substitution.
    d. The contractor shall indicate and submit evidence in writing of those materials or articles called for in the specifications that are not obtainable for installation in the work within the time limits of the contract. Failure to indicate the above, within 30 days after the signing of the contract, will be deemed sufficient cause for the denial of request for the extension of the contract time.
    e. All material shall be delivered so as to insure a speedy and uninterrupted progress of the work. Such material shall be stored so as to cause no obstruction and so as to prevent overloading of any portion of the structure, and the contractor shall be entirely responsible for damage or loss by weather or other cause.

f. Within 30 days after signing the contract, the contractor shall submit for approval of the architect/PMC a complete list of all material he and his sub-contractors propose to use in the work of definite brand or make which differ in any respect form those specified; also the particular brand of any article where more than one is specified as a standard. He shall also list items not specifically mentioned in the specifications but which are reasonably inferred and necessary for the completion of the work.

g. Inspection: All materials and workmanship shall be subject and workmanship shall be subject to inspection, examination, and test by the architect/PMC at any and all times during manufacture and/or construction. The architect/PMC shall have the right to reject defective materials and workmanship or require its correction. Rejected workmanship shall be satisfactory replaced with proper material without additional charge therefore and the contractor shall promptly segregate and remove the rejected material form the works. If the contractor fails to proceed at one with the replacement or rejected materials and or the correction of defective workmanship, the architect/PMC may by contract or otherwise replace such materials and or correct such workmanship and charge the cost thereof to the contractor, or may terminate the right of the contractor to proceed further with the work.

The contractor shall furnish promptly without additional charge all reusable facilities, labor and materials necessary for the safe and convenient inspection and test that may be required by the architect/ PMC.

41. Defects.

a. The contractor shall make good at his own cost and to the satisfaction of the architect/ PMC, all defects, shrinkages or small faults, arising in the opinion of the architect/ PMC from work or materials not being in accordance with the drawings or specifications or schedule of quantities or the instruction s of the architect/PMC, which may appear within "Defects Liability Period" referred to in the appendix.

b. Such defects shrinkage's shall upon directions in writing of the architect/ PMC and within such reasonable time as shall be specified therein be amended and made good by the contractor, at his own cost unless the architect/PMC shall decide that they ought to be paid for such amending and making good and in case of default the owner may employ and pay other contractor to amend and make good such defects, shrinkage, settlements or other faults and all damages loss and expense consequent thereon or incidental thereto shall be made goods and borne by the contractor and such damage, loss or expense shall be recoverable form him by the owner or may be deducted by the owner upon the architect's /PMC's certificate in writing form any amount due or may become due to the contractor or the owner may, in lieu of such amending and making good by the contractor deduct form any moneys due to the contractor a sum to be determined by the architect/PMC as equivalent to the cost of amending such work and in the event of the retention amount being insufficient recover the balance form the contractor, together with any expenses the owner may have incurred in connection therewith.

42. Termination by the Owner

a. Default:- If the contractor shall make default in any one or more of the following respects, that is to say;

i. if he without reasonable cause wholly suspends the carrying out of the works before completion thereof, or

ii. if he fails to proceed regularly and diligently with the works, or

iii. If he refuses or persistently neglects to comply with the written notice form the architect/PMC requiring him to remove defective work or improper material or goods and by such refusal or neglect the work is materially affected, or

iv. If he fails to comply with the provision of clause 30.

v. Then the architect/PMC may give him the notice by registered post or recorded delivery specifying the default, and if the contractor either shall continue such a default for 14 days after

receipt of such a notice and shall at any time thereafter repeat such a default (whether previously repeated or not.) then the owner without prejudice to any other rights or remedies may within ten days after such continuance or repetition of notice by registered post or recorded delivery forthwith terminate the employment of the contractor under his contract, provided that such notice shall not be given unreasonably or vicariously.

b. **Bankruptcy of Contractor:**- In the event of the contractor becoming bankrupt or making a composition or arrangement with his creditors or being a company having a winding up order made or (accept for purposes of reconstruction) a resolution for voluntary winding up past or a receiver or manager of his business or undertaking duly appointment or possession taken. By or on behalf of the holders of any debentures secured by a floating charge, of any property comprises in or subject to the floating charge the employment of the contractor under his contract shall be forthwith automatically terminated by the said employment may be reinstated and continued if the owner and the contractor, his trustee in bankruptcy, liquidation, receiver or manager as the case may be shall so agree.

c. The owner shall be entitled to terminate the employment of the contractor under this contract if the contractor shall have offered or given or agreed to give to any person any gift or consideration of any kind as an inducement or reward fordoing or for bearing to do or for having done or foregone to do any action in relation to the obtaining or execution of this contract with the owner, or for showing or forbearing to show favour or disfavour to any person in relation t to hits contract or any other contract with the owner, or if the like acts shall have been done by any person employed by the contractor or acting on his behalf(whether with or without the knowledge of the contractor) , or if in relation to his contact or any other contact with the owner the contactor or any person employed by him or acting on his behalf shall have committed any offence under the Prevention of Corruption Act, or shall have given any fee or reward the receipt of which is an offence under the Local Government Act.

d. In the event of the employment of the contractor being terminated as aforesaid and so long s it has not been reinstated and continued, the following shall be the respective rights and duties of the owner and contractor.

   i. The owner may employ and pay other persons to carry out and complete the works and he or they may enter upon the works and use all temporary buildings plants, machinery, appliances, goods and materials intended for, delivered to and placed on or adjacent to the works and may purchase all materials and goods necessary for the carrying out and completion of the works.

   ii. The contractor shall if so required by the owner or architect within 14 days of the date of termination assigned to the owner without payment the benefit of any agreement or the supply of materials or goods and / or for the execution of any works for the purposes of this contact by on the terms that a supplier or sub-contractor shall be entitled to make any reasonable objection to any further assignment thereof by the owner. In any case the owner may pay any supplier or sub-contractor for any materials or goods delivered or works executed for the purpose of the contact(whether before or after the date of the termination) In so far as the price thereof has not already been paid by the contractor. The owner's rights under this paragraph are in addition to his rights to pay nominated sub-contactors as provided n clause 24.b and payments made under this paragraph may be deducted form any sum due or to become due to the contractor.

   iii. The contactor shall as and when required in writing by the architect/ PMC so to do (but not before) remove form the works any temporary buildings, plants, tools, equipment's goods and materials belonging to or hired by him. If within a reasonable time after any such requirement has been made the contract, has not complied therewith then the worn may (but without being responsible for any loss or damage) remove and sell any such property of the contractor, holding the proceeds less all costs incurred to the credit of the contractor.

   iv. The contractor shall allow or pay to the owner in the manner here in after appearing the amount of any direct loss and /or damage caused to the owner by the termination. Until after completion of the works under paragraph(a) of this sub-clause the owner shall not be bound by any

provisions of this contract to make any further payment to the contract, but upon such completion and the verification within a reasonable time of the accounts therefore the architect/PMC shall certify the amount of expenses properly incurred by the owner and the amount any direct loss and / or damage caused to the owner by the termination and if such amounts when added to the monies paid to the contractor before the date of termination exceed the total amount which would have been payable on due completion in accordance with this contract, the difference shall be a debt payable to the owner by the contractor, and if the said amounts, when added to the said monies be less than the said total amounts, the difference shall be a debt payable by the owner to the contractor.

43. Possession Completion and Postponement

a. On the date for commencement stated in the appendix to these conditions possession of the site shall be given to the contractor who shall thereupon begin the works and regularly and, diligently proceed with the same, and who shall complete the same on or before the date for completion stated in the said appendix subject nevertheless to the provisions for extension of time contained in clause 44 of these conditions.

b. The architect/PMC may issue instructions in regard to the postponement of any work to be executed under the provisions of this contract.

c. If at any time or times before virtual completion of the work the owner with the consent of the contractor shall take possession of any part or parts of the same for handing over to the finishing contractor or other agency, then notwithstanding anything expressed or implied elsewhere in this contract;

d. Such part or parts shall not be deemed to be virtually complete.

e. Virtual completion of such part or parts would occur on the completion of the last part of the structure under this contract.

f. The contractor shall not claim that such part or parts are complete and request refund of payments in lieu thereof.

44. Extension - Upon it becoming reasonably apparent that the progress of the works is delayed, the contractor shall forthwith give written notice of the cause of the delay to the architect/PMC, and if in the opinion of the architect/PMC, the completion of the work is likely to be or has been delayed beyond that date for completion stated in the appendix to these conditions or beyond any extended time previously fixed under this clause as mentioned under clause no 32 a J

Then the architect/PMC shall as soon as he is able to estimate the length of the delay beyond the date or time aforesaid make in writing a fair and reasonable extension of time for completion of the works, provided always that the contractor shall use constantly his best endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the architect/ PMC to proceed with the work.

45. Damages for Non-completion

a. If the contractor fails to complete the works by the date specified in these conditions or within any extended time fixed under clause 44 of these conditions and the architect /PMC certifies in writing that in his opinion the same ought reasonably so to have been completed, the contractor shall pay or allow to the owner a sum calculated at the rates stated in the appendix as agreed liquidated damages for the period during which the said work shall so remain or have remained incomplete, the owner may deduct such damages from many monies otherwise payable to the contractor under this contract.

46. Virtual completion and defects liability period. –

a. When in the opinion of the architect/PMC the works are practically completed, he shall forthwith issue a certificate to that effect and virtual completion of the works shall be deemed for all the purpose of this contract to have taken place on the day named in such certificate.

b. Any defects, shrinkage or other faults which are appeared within the "Defects Liability period" stated in the appendix to these conditions and which are due to materials and workmanship not in accordance with his contract shall be specified by the architect/PMC in a schedule of defects which he shall deliver to the contractor not late than 14 days after the expiration of the said defects liability period and within a reasonable time after receipt of the schedule the defects, shrinkage's and other faults therein specified shall be made good by the contractor and (unless the architect/PMC shall otherwise instruct in such case the contract sum shall be adjusted accordingly) entirely at his own cost.

c. Notwithstanding sub-clause(b) of this conditions the architect/PMC may whenever he considers it necessary so to do, issue instructions requiring any defect, shrinkage's or other fault which shall appear within the defects liability period named in the appendix to these conditions and which is due to materials and workmanship not in accordance with this contract to be made goods and the contractor shall within a reasonable time after receipt of such instructions comply with the same(and unless the architect/PMC shall otherwise instruct in which case the contract sum shall be adjusted accordingly) entirely at his own cost. Provided that no such instruction shall be issued after 14 days from the expiration of the said defects liability period.

d. When in the opinion of the architect/PMC any defects, shrinkage's or other defaults which he may have required to be made good under sub-clause (b) & (c) of this condition shall have been made good he shall issue a certificate to that effect, and completion of making good defects shall be deemed for all the purposes of this contract to have taken place on the day named in such certificate.

e. In no case shall the contractor be required to make good at his own cost any damage which may appear after the virtual completion of the work, unless the architect/PMC shall certify that such damage is due to injury which took place before virtual completion of the works.

47. Loss and expenses caused by disturbance of regular progress of the works:

a. If upon written application being made to him by the contractor the architect/PMC is of the opinion that the contractor has been involved in direct loss and / or expenses for which he would not be reimbursed by a payment made under any other provision in this contract by reason of the regular progress of the works or of any part thereof having been materially affected by;

b.

i. The contractor not having received in due time necessary instructions, drawings detail or levels from the architect for which he specifically applied in writing on a date which having regard to the date of completion stated in the appendix to these conditions was neither unreasonably distant form nor unreasonably close to the date on which it was necessary to receive the same; or

ii. The opening up for inspection of any work covered up or the testing of any work, materials or goods in accordance with clause 21 of these conditions (including making good in consequence of such opening up or testing),unless the inspection or test showed that the work materials or goods were not in accordance with this contract; or

iii. Any discrepancy or divergence between the contract drawings and / or the contract bills; or

iv. Delay on the part of the artists, tradesman or others engaged by the owner in executing work not forming part of this contract; or Architect's /PMC's instructions issued in regard to the postponement of any work to be executed under the provisions of this contract; and if the written application is made within a reasonable time of it becoming apparent that the progress of the work or of any part thereof has been attested aforesaid; Then the architect/PMC shall ascertain the amount of such loss and / or expense. Any amount form time to time so ascertained shall be added to the amount, which would otherwise be stated as due in such certificate.

c. The provisions of this conditions are without prejudice to any other rights and remedies which the Contractor may posses.

48. **Payment Withheld -** The architect/PMC may withhold on account of a subsequently discovered evidence nullify the whole or a part of any certificate to such extent as may be necessary in this reasonable opinion to protect the owner from loss on account of all mentioned in 36.(i) – i. to v When the above grounds are removed payments shall be made for amounts withheld because of them.

49. **Prime Costs**

a. Where Prime cost (P.C.) prices or provisional sums of moneys are provided for any goods or work in the specifications or schedule of Quantities the same are exclusive of any trade discounts or allowances, discount for cash, or profit which the Contractor may require and of carriage and fixing.

b. All goods or work for which prime cost prices or provisional sums of money are provided may be selected or ordered from any manufacturers or firms at the discretion of the Architect and the Employer reserves to himself the right of paying direct for any such goods or work and deducting the said prices or sums from the amount of contract. Should any goods or work for which prime cost prices or provisional sums are provided or portions of same be not required such prices or sums, together with the profits allowed for the same and such additional amounts as the Contractor may have allowed for carriage and fixing, will be deducted in full from the amount of the Contract. Whether the goods be ordered by the Contractor or otherwise, the Contractor shall, at his own cost, fix the same if called upon to do so and the Contractor shall also receive sign for such goods and be responsible for their safe custody as and from the date of their delivery upon the works.

c. In case in which the provisional quantities of material are contained in the Contract, the Contractor shall provide such material to such, amounts or to greater amounts as the Architect shall direct in writing as the net rates at which he shall have priced such items in his schedule of quantities, should however, any such items, be entirely omitted, which omissions shall be at the Architect's discretion no profit on such items shall be allowed to the Contractor.

d. No prime costs sum or sums (or any portion thereof) shall be included in any Certificate for payment to the Contractor until the receipted accounts relating to them have been produced by the Contractor to the Architect, such accounts shall show all discounts and any sum or sums in respect of such discounts shall be treated as trade discount, provided always that should the Contractor request the Architect in writing to issue a certificate on the Employer for such sum or sums due either on account or in settlement to a Sub-Contractor directly, the Architect shall, upon satisfying himself that the Sub – contractor is entitled to the same, so issue the Certificate, and such sum or sums shall be deducted from the amount of the Contract at the settlement of accounts and any profit or further sum to which the Contractor is properly entitled in respect of such Sub-contract, and which is in conformity with the terms of settlement of account although the amount of certificate to the Sub-contractor had been included in a certificate drawn in favor of the Contractor.

e. If the Contractor neither produces the receipt, nor gives authority to the Architect/Consulting Engineer to issue a certificate in favor of such Sub-Contractor directly, the Architect may, upon giving the Contractor seven days in writing of his intention to do so, issue to the Sub-Contractor such Certificate directly on the Employer and obtain the receipt from the Sub –Contractor which receipt shall be deemed a discharge for the amount, such certificate as though given by the Contractor. In the event of such default on the part of the Contractor, he shall not be allowed any profit he may have added in the Schedule of Quantities upon such Sub-contractor.

f. The exercise of the option before referred to by the Contractor and the issue of Certificate as before described to Sub-contractors upon the Contractor's request or the direct issue of certificate by the Architect to the Sub-Contractor shall not, however, relieve the Contractor from any of the liabilities in respect of insufficient, faulty or incomplete work/s of the Sub –Contractor for which he may be liable under the terms of the contract.

g. If any provisional items are provided for work of a nature usually carried out by the contractor in the ordinary course of his business, the Employer shall give the Contractor an opportunity of tendering for the same without prejudice to the employer's right to reject the lowest or any tender.

50. Variations in Prime Costs

a. The architect/PMC may issue instruction requiring a variation and he may sanction in writing any variation made by he contractor otherwise than pursuant to an instruction of the architect/PMC. No variation required by the architect/PMC or subsequently sanctioned by him shall vitiate this contract.

b. The term "Variation", as used in these conditions , means the alteration or modification of the design, quality/quantity of the work as shown on the contract drawings and desired b or referred to in; the contract bills, and includes the addition, omission or substitution of any work, the alteration of the kind of standard of any of the materials or goods to be used in the work, and the removal form the site of any works materials or goods, executed or brought thereon by the contractor, for the purposes of the work other than work, materials or goods which are not in accordance with this contract.

c. The architect/ PMC shall issue instructions in regard to the expenditure of Prime Cost* and provisional sums included in the contract bills and of prime cost sums which arise as a result of instructions issued in regard to the expenditure of provisional sums.

*The term "Prime Cost "may be indicated by the abbreviation "P.C." in any document relating to this contract (including the contract bills) and wherever the abbreviation is used it shall be deemed to mean "Prime Cost".

d. All variations required by the architect/PMC or subsequently sanctioned by him in writing and all work executed by the contractor for which provisional sums are included in the contract bills (other than work from which a tender made under clause 24.g of these conditions has been accepted). Shall be measured and valued by the architect/PMC that shall give to the contractor an opportunity of being present at the time of such measurement and of taking such notes and measurements as the contractor may require. The valuation of variations and of work executed by the contractor for which a provisional sum is included in the contract bills, (other than work for which a tender has been accepted as aforesaid) unless otherwise agreed, shall be made in accordance with the following rules.

   i. The price in the contract bills shall determine the valuation of work of similar character executed under similar conditions as work priced therein.

   ii. The said prices, where work is not of a similar character or executed under similar conditions as aforesaid, shall be the basis of prices for the same so far as may be reasonable, failing which a fair valuation thereof shall be made.

   iii. Where work cannot properly be measured and valued the contractor shall be allowed day work rates on the prices prevailing when such work is carried out (unless otherwise provided in the contract bills.)

      1. At the rates if any, inserted by the contractor in the contract bills or in the form of tender or,
      2. When no such rates have been inserted, at the rates prevailing in the market, for material and labor and at the control rates for the controlled materials including in all cases, the rate for delivery of the material at the work.

e. Effect shall be given to the measurement and valuation of variations under sub-clause (d) of this condition in term certificates and by adjustment of the contract sum; and effect shall be given to the measurement and valuation of work for which a provisional sum is included in the contract bills under

the said sub-clause in Interim Certificate and by adjustment of the contract sum in accordance with clause 36 of these conditions.

f. If upon written application being made to him by the contractor, the architect/ PMC is of the opinion that a variation or the execution by the contractor of work for which a provisional sum is included in the contract bills(other than work for which a tender made under clause 24.f of these conditions has been accepted) has involved the contractor in direct loss and /or expense for which he would not be reimbursed by payment, in respect of a valuation made in accordance with the rules contained in sub-clause (d) of the condition and if the said application is made within reasonable time of the loss or expense, having been incurred, then the architect/PMC shall ascertain the amount of such loss or expense. Any amount, from time to time so ascertained, shall any such amount be added to the amount which would otherwise be stated as due in such certificate.

51. The decision, opinion, direction, certificate (except for payment) with respect to all or any of the matters under clauses 11a, 11b, 12,19, 21, 32 (a,b,c,d,f) and 34 hereof which matters are herein referred to as the except matters shall be final and conclusive and binding on the parties hereto and shall be without appeal. Any other decision, opinion, direction, certificate or valuation of the Architect or any refusal of the Architect to give any of the same shall be subject to the right of arbitration and review in the same way in all respects (including the provision as to opening the reference) as if it were a decision of the Architect under the following clause.

52. All disputes and differences of any kind whatever arising out of or in connection with the Contract or the carrying out of the works (whether during the progress of the works or after their completion and whether before or after the determination, abandonment or breach of the contract) shall be referred to and settled by the Consulting Architect who shall state his decision in writing, such decision may be in the form of a Final Certificate or otherwise.

a. The decision of the Consulting Architect with respect of any of the excepted matters shall be final and without appeal as stated in the preceding Clause. But if either the employer or the Contractor be dissatisfied with the decision of the Consulting Architect on any matter, question of dispute of any kind (except any of the excepted matters) or as to Contractor may claim to be entitled, then and in any such case either party (the employer or the Contractor) may within twenty eight days after receiving notice of such decision give a written notice to the other party through the Consultant requiring that such matters in dispute be arbitrated upon. Such written notice specify the matters which are in dispute and such dispute or difference of which such written notice has been given and no other shall be and is hereby referred to the Arbitration and final decision of a single Arbitration being a fellow of the Indian Institute of Architects to be agreed upon and appointed by both the parties or in case of disagreement as to the appointment of single arbitrator to the Arbitration of two Arbitrators both being fellows of the Indian Institute of Architects, one to be appointed by each party, which Arbitrators shall before taking upon themselves the burden of reference appoint an Umpire.

b. The Arbitrator, the Arbitrators or the Umpire shall have power to open, review and revise any certificate, opinion, decision, requisition or notice, gave in regard to the excepted matter referred to the preceding Clause, and to determine all matters in dispute which shall be submitted to him or them and of which notice shall have been given as aforesaid.

c. Upon every or any such reference the cost of and incidental the reference and Award respectively shall be in the direction of the Arbitrator, or Arbitrators or the Umpire who may determine the amount thereof, or direct the same to be taxed as between attorneys and employer or as between party and parties, and shall directed by whom and to whom and in what manner the same shall be borne and paid. This submission shall be deemed to be a submission to Arbitration within the meaning of the Indian Arbitration thereof. The award of Act, 1940, or any statutory modification thereof. The Award of the Arbitrator or Arbitrators or the Umpire shall be final and binding on the parties.

d. Such reference except as to the withholding by the Architect of any certificate under clause 34 to which the Contractor claims to be entitled, shall not be opened or entered upon until after the completion or alleged completion of the works or until after the practical cessation of the works arising from any cause unless with the written consent of the Employer and the Contractor. Provided always that the Employer shall not withhold the payment of an Interim Certificate, not the Contractor, except with the consent in writing of the architect, in any way delay the carrying out of the works by reason of any in way delay the carrying out of the works by reason of any such matters, question or dispute being referred to Arbitration, but shall proceed with the work with all due diligence and shall, until the decision of the arbitrator or Arbitrators or the Umpire to be given, abide by the decision of the Architect and no Award of the arbitrator or the arbitrators or the Umpire shall relieve the contractor of his obligations to adhere strictly to the Architect's instructions with regard to the actual carrying out of the works. The Employer and the Contractor hereby also agree that Arbitration under this Clause shall be a condition precedent to any right of action under the contract.

53. Contractor to keep Site clean - During the progress of the works, the Contractor shall keep the site reasonably free from all unnecessary obstruction and shall store or dispose off any constructional Plant and surplus materials and clear away from the site any wreckage, rubbish or Temporary works no longer required.

54. Clearance of site completion - On the Completion of the works, the Contractor shall clear away and remove from the Site all Constructional Plant surplus materials, rubbish and Temporary works of every and level the whole of the Site and works clean and in a workmanlike condition to the satisfaction of the Consultant.

55. LABOUR

a. Conditions for Engagement of Labour: -The Contractor shall provide all labour necessary or required by the Consultant for the Construction, completion and maintenance of the works. The contractor shall make his own arrangements for the engagement of all labour. In respect of the engagement, employment, transport paying, feeding housing and working conditions of labour and of all other matters connected therewith the Contractor shall at all times during the continuance of the Contract conform in all respects with and carry out all obligations imposed on him by the provisions and requirements of any law and of any Regulations or Orders of any Government (Central/Provincial or Local) or any authority which may be applicable including any such law Regulations or Order passed or made or coming into force after the date of signing of Contract. In particular but without prejudice to the generality of the foregoing provisions the Contractor shall conform with and do or refrain from doing anything he may be required to do or refrain from doing by any legislation or Ordinances so far as applicable relating to factories or relating to industrial disputes and any Regulations or Orders there under.

56. Blasting: Where blasting has to be resorted to for rock cutting, it shall be the responsibility of the contractor to arrange for the following at his entire risk, cost and responsibility.

a. Permission from all the connected public authorities such as Municipal Corporation, Inspector of Explosives, Police, and Highway Authorities etc. shall be obtained.

b. Fees, Royalties and any other levies attendant on such blasting work shall be entirely borne by the contractor.

c. All precautionary measures such as notices to adjoining property and other agencies working in and around the plot, signalling and watch etc. Shall strictly adhere to according to the various regulations in force.

d. All Risk-Insurance in respect of the blasting hazards to men and materials within and in the vicinity of the plot. This insurance shall be apart from the Contractors All-Risk-Insurance Police stipulated under General Conditions unless the Contractor incorporates blasting hazards and its coverage in the said general policy.

THE CONDITIONS HEREIN REFERRED TO AS SPECIAL CONDITIONS OF CONTRACT:

1. **Other Materials: -** All materials for the work shall be procured by the contractor & stored for use at his own cost.
2. **Electricity: -**. The Electrical connection can be supplied to the Contractor at fixed Sub meter from BAR COUNCIL if BAR COUNCIL desires so and agrees to. In this case the contractor will have to arrange for cable and tested sub-meter up to construction site. The deduction at the rate of Rs 20 per UNIT or as mutually decided by Contractor and BAR COUNCIL will be made from each running bill as meter reading. The arrangement for ELCB, MCB, Distribution cable Network and 3 Phase Sub Meter shall be made on site by the contractor at his own cost. But considering the scanty nature of Electrical supply in Maharashtra, the contractor is advised to keep a D.G. set of adequate capacity so as to facilitate uninterrupted construction activity despite MSEB failures The expenditure for diesel & maintenance of the D. G. set as well as the Electrical consumption shall be the responsibility of the contractor at his cost. Contractor shall conduct this act well in advance in order to avoid any delay in project period.
3. **Water: -** Water will not be given by Employer in Work Site at all; the Tenderer shall make his own arrangement for the supply and distribution of water at his own Cost. Tenderer has to make additional arrangements such as obtaining required permissions for laying pipe line net work, storage facility etc. at his own Cost. Tenderer has to make additional arrangements such as obtaining required permissions for laying pipe line network, storage facility etc. at his own cost. If it is found at any point that BAR COUNCIL domestic and lift irrigation network is being used by the contractor for water supply, a fine of rupees 5000 shall be levied on the contractor for every such incidence. Contractor shall submit the water test report of the said used water to the client.
4. **Artificial Sand** of approved quality shall be only used. All RCC work shall be carried out in artificial sand. The same should be have proper gradation described in the d only. detailed specification & will be washed & sieved if required, the maximum silt percentage will not exceed that allowed by relevant I.S. code for R.C.C. work .
5. **Bricks: -**Best locally available first class Red bricks shall be used for all the brick masonry works. Where mentioned specifically in the drawings or in the BOQ, The wire cut, Table moulded bricks shall be used no substitute in the material or make shall be accepted.
6. **Centring and Shuttering:** The Contractor shall use steel / plywood centring / shuttering / Jacks / Props, for columns, beams and slabs.
7. **Advance on Materials-** The owner will not give advance for the purchase of any material required for the works.
8. **Security Deposits E.M.D. & Retention Money -** Total 5% Security Deposit which includes 2.5% initial Security Deposit. (Inclusive EMD amount), to be paid at the time of Work Order and Balance 2.5% as Retention amount, to be Deducted from RA bills at minimum 10% of the Billed amount for each bill.
9. **Return of SD-** 75% of the security deposit will be refunded upon total completion of the project as per Scope of work specified in this tender. (To be certified by the Architect / PMC).
10. **Return of remaining SD after Defects Liability Period-** The remaining 25% of the Security Deposit will be returned upon the successful completion of the Defect Liability Period. (To be certified by the Architect / PMC).
11. **Penalty: -** The timely completion of the project is of vital importance to the Client / Owner; & therefore, failure of the contractor in completing the work within the time frame shall result in penalising the contractor with a penalty as mentioned in liquidity damages in the Main Tender Notice.
12. **Award on Completion** of Work before time: If the Contractor completes the work before the stipulated completion period, he is eligible for a award as may be decided by the Client.

13. **Final Bill :** On completion of the total work the contractor can submit his final bill. However the contractor is required to submit all the necessary NOCs from requisite local authority, adjust the amounts towards water and electricity charges (If any) before submitting the final bill. All the bills submitted till date will be reviewed by the Architects as well as the Clients / Owner at the time of final bill and any discrepancy found in the previous bills shall also be settled at the time of final bill certification.

14. **Price escalation:** No price escalation shall be accepted by the owner since basic rates of all the items, which may witness rate fluctuation during the contract period, have been mentioned and further since the period of contract is small.

15. **Responsibility under various Acts, Rules etc**

    a. The contractor will have to observe all the Rules and Regulations prescribed under the Factories Act, Provident Fund Act, E.S.I. act, Income Tax., Shops and Establishments Act, workmen's Compensation Act, and such other Acts and Labour laws as may be applicable and any liability arising by non-observance of the above Regulations, and Acts in respect of his employees and his Sub-contractors employees in respect of this Contract work will have to be fully assumed and met by the Contractor. The Contractor should ensure that he satisfies all the above Regulations.

    b. E.S.I. due or any other Statutory dues payable on all the above works (including the immediate owner's share) engaged by the Contractor or his Sub-contractors in the owner's premises as herein mentioned will be the liability of the contractor and owner shall not assume any responsibility, legal or otherwise in this respect.

16. **The following drawings and papers shall form part and parcel of the contract:**

    a. All the Architectural working drawings, R.C.C. and structural working drawings including the drawings issued at the time of commencement of the work and also subsequent drawings added to the above set of drawings.

    b. The specifications mentioned on the schedule of quantities are to be read along with the detailed specifications, Conditions of the Contract (General and Special) and the Instructions to the tenderers.

    c. In the case of technical disputes, decision of the Consultant MITIMITRA CONSULTANTS PVT. LTD will be final and binding on both the parties.

17. **INSURANCE -** The Contractor shall insure all his staff and workers against accidents as per the workers Compensation Act. The contractor shall obtain these police within 30 days from the date of work orders. The Contractor shall also provide third Insurance cover as per Clause 28 of general conditions of contract.

18. **RATE ANALYSIS AND ITEMS -** The Contractor will be required to furnish analysis of all the rates quoted by him for all the items along with the tender and for all the extra items required to be executed on the site, which should be got approved from the consultant Architect before the execution of the particular item. If so required by the Architect, he shall also furnish the Original vouchers, bills, quotations etc. For purchase of Basic rate items, contractor should submit original bills immediately on delivery at site.

19. **ROYALTIES, FEES ETC.-** All quarry fees, octroi dues, ground rent for stacking materials if any, shall be paid by the Contractor directly to the concerned authorities.

20. **The contractor will not be paid any extra rate more than the tender rate in case of increase in the quantities to any extent.**

21. **BMC NOCs** : Before completion, and submission of full and final bill , the contractor is required to submit NOCs from **BMC** Drainage , water, Line development, Road, Tree authority, Encroachment, DP, vermiculture, Health and Traffic, rain water harvesting etc. the owner will supply necessary documents and shall reimburse the payments made by the contractor, upon submission of receipts of the same from PMC. Contractor is bound submit any other NOC made mandatory by PMC at that prevailing period of project execution. Fire and lift NOC'S will be obtained by respective vendors.

22. **The schedule of Tender** includes the quantities of items for all floors at all levels. Contractor will not be paid any extra charges for Lead & Lift hence Contractors are suggested to quote the rates accordingly.

23. **TAXATION: -** works Contract Tax, Sales tax, Provident Fund ESI or any other State Govt. or Central Govt Tax as applicable entirely to the cost of the Contractor, all the formalities necessary for the same shall be completed by the contractor immediately within one week of getting the Letter of intent From the Client. **as contractor should fill the rate exclusive of GST and GST shall be mentioned separately**. Client will not be responsible for any liability towards Late or Non payment of the same. The method of calculation of taxation shall be as advised by the Client's taxation consultants in writing. Architects will not be held responsible for any discrepancy found in the calculation of taxation.

24. **Plan of Operations:** Before commencing the works the Contractor shall supply to the architect for his approval

    a. Shop Drawings showing the general arrangement of his temporary buildings, access roads and other temporary works.
    b. General information of all construction, pumping, washing of sand and aggregate, excavation, piling, haulage, erection and other plant and equipment.
    c. Provisions for dealing with water encountered on the works.
    d. Order in which the Contractor proposed to executed the temporary and permanent works to be indicated by diagrams and descriptions. This will be subject to adjustment and approval by the Architect.
    e. A bar chart or Project schedule (MS Project worksheet) indicating the work planning & programming by the contractor

25. **Contractor to provide –** The contractor shall provide a notice board, on proper support 10 x 6 in a position approved by the Architect. He shall allow for painting and lettering, stating name of the work shall be in size not exceeding 2" in height and all to the approval of the Architect with any other item of specific relevance to the Contract, if requested by the Architect.

26. **Standard Specifications:-** Unless specifically mentioned otherwise all the relevant codes and standard published by the Bureau of Indian Standards and all other codes/standards which may be published by them before the other codes/standards which may be published by them before the acceptance of the Contract shall apply and govern in respect of acceptance of the Contract shall apply and govern in respect of design, workmanship, quality and properties of materials and testing. The following should be observed while constructing items.

    a. Honey Combing in any type of concrete including PCC will not be permitted All Honey combed area will have to be broken and redone as per Architect / Project Consultant's instructions.
    b. The compaction of murum in 20 cm depth to 95% proctor density to be ensured.
    c. Actual weight of reinforcement received at site and its rolling margin must be immediately informed to the society for all diameter of bars.
    d. All concrete & mortar must be mixed with mechanical mixers.
    e. At the time of concreting of slab, stand by vibrator is essential.
    f. All water to be added to the concrete mixer must be by approved measured container.
    g. For water curing of columns, columns should be properly covered by gunny bags during curing period.

27. **Safety Measures: -** The Contractor shall organize his operations in a workman like manner and take all necessary precautions to provide safety and prevent accidents on the site to both persons and property. The contractor shall provide and maintain at his expense all necessary scaffolding and fencing to the satisfaction of the Architect for the due erection and protection of the work, and materials to be used on the work, and shall conform to every other condition or condition set out in relevant clause of the contract.

    The contractor shall allow in his price for the use of scaffolding by all sub-contractors and other contractor but he will not be required to provide special scaffolding for any sub-contractor. In particular the contractor shall ensure compliance with the following standard safety codes:

IS : 3696 (Pt. I)	:	Safety code fro scaffolds and ladders, Pt. I scaffolds.
IS : 3696 (Pt. II)	:	Ditto Pt. II, ladders.
IS : 4130	:	Safety code for demolition work.
IS : 4014 (Pt. II	:	Code of practice for steel tubular scaffolding Pt. II safety regulations for scaffolding

28. SAFETY PRECAUTION

The following important precaution should be included in the rates.

1. All safety norms and regulations shall be strictly adhered to at all times, and at the cost of Contractor without any extra Claim / Payment
2. The contractor shall ensure that all existing works, such as flooring, walls, partitions, etc., are properly protected and remain undamaged. Care should be taken to avoid any scratches, patches, or other damage during the course of the work, Cost of any damages shall be recovered from the Contractor Bills / Security Deposit / Retention Amount.
3. Metal barricading and safety nets shall be erected whenever and wherever necessary, as directed by the Architect / PMC and in consultation with the Engineer-in-Charge
4. Suitable and strong double scaffoldings with adequate handrails and safety belts, helmets etc. shall be provided for all workmen, supervisors, and engineers for all works that cannot be done safely from ground. Unless permitted or otherwise, scaffolding shall be of steel with adequate lateral supports & bracing etc.
5. No portable single ladder shall be of more than 5m length. The width between the side rails shall not be less than 30 cm and distance between two adjacent rungs shall not be more than 30 cm. Whenever a ladder is used, an extra labour shall be engaged in holding the ladder.

29. Sub- Contractor - The contractor shall ascertain from each sub-contractor, or other contractors as directed by the Architect, all particulars relating to his work, with regard to the order of its execution and the position in which chases, holes and similar items will be required, before the work is put in hand, as no claim for extras will be alleged for cutting away work already executed in consequence of any neglect by the contractor to ascertain the particular, before hand.

30. Quality :- All materials for incorporation into the works and the workmanship shall be of the best quality of their respect give kinds, specified herein and shall be obtained from the sources and suppliers approved by the Architect or his representative or, where tests are not laid down in this specification, with the requirements of the latest issue of the relevant Indian Standards approved by the Architect. The contractor shall immediately remove from the site any material and/or workmanship which in the opinion of the Architect is defective or unsuitable and shall substitute proper materials and/or workmanship forthwith.

31. **Inspection and Testing -** All materials before being incorporated into the works shall be subjected to inspection and testing as provided in the conditions of contract and elsewhere in the specifications. Unless otherwise specified, the cost of all samples and tests required by the specification or the approved standard shall be deemed to be included in the contract rates. No materials shall be used in the works unless the Consultant or his representative has first approved them.

32. **Cement Concrete and Steel testing:** For the Purpose of assuring desired concrete strengths, the nominal mix of the sand metal and cement to be obtained from the approved laboratory well in advance before first concreting is done, for every slab the sample concrete cubes will have to be taken and tested in the laboratory(7 day test and 28 days both), the same shall be tested by external structural diagnosis agency by using appropriate means for the executed work the contractor shall be responsible for achieving minimum desired concrete strength as per the IS prescribed for the same in Technical specifications.

33. Samples:- Samples of all materials proposed to be used or incorporated in the works and to be supplied by the Contractor may be called for at any time by the Architect or his representatives.

34. **Independent Test/Analysis:-**The contractor shall, if required by the Architect, arrange to test materials and/or analyst approved by the Architect, including transport, in order to prove their soundness and efficiency. If after any such test the work of portion of the work is found, in the opinion of the Architect, to be defective or unsound, the contractor shall pull down and re-execute the same at his cost. Defective materials shall be removed from the site.

35. **Contractor to include in his rates:-** All taxes, levies duties etc. on construction materials and/or labour involved in the items of work for the job. Besides above the contractor shall include in his rates, all listed in this section.

    a. **Treasure trove** – should any treasure, fossils, minerals, or works of art of antiquarian interest be found during the excavation, or while carrying works, such treasure, fossils or materials, etc. shall be the property of the owner. The contractor shall give immediate notice to the Architect/Consulting Engineer of any such discovery and shall make over any treasure to the Owner on demand.

    b. **Setting out** - the contractor shall set out the work so as to conform to the relevant clause of the conditions of contract herein.

    c. **Benches –** the contractor is to construct and maintain proper benches at the intersection of all main walls in order that the lines may be accurately checked at a time. These benches will consist of sal-wood posts minimum diameter 3" driven into the ground at suitable distance as directed. The tops to be half checked and connected with batten adequate length into which will be driven wire nails on the centre lines of the columns and walls, inside and outside faces of foundation trenches etc. in order that lines may be stretched between the benches and the accurate intersection of the excavations, centre lines of walls, columns etc. may be clearly indicated.

    d. **Access to site: -** The contractor is to include in his rates for forming access to the site with all temporary roads and gang ways required for the works.

    e. **Access for Inspection:-**The contractor to provide at all times during the progress of the work and maintenance period, proper means of access, with ladders, gan-ways etc. and the necessary attendance to move and adopt, as directed, for the inspection or measurement of the works, by the Architect/Consulting or his representative.

    f. **Cost of Transportation** -The contractor shall allow in his for all unloading, transporting, stacking and storing or supplies of goods and materials for this work on the site and at the places approved from time to time by the Architect. The contractor shall allow in his price for transport of all materials controlled or otherwise to this site.

    g. **Dimensions: -** Figured dimension, shall in all cases be accepted in preference to scaled sizes. Large Scale details take precedence over small-scale drawings in case

    h. of discrepancy; the contractor is to ask for before proceeding.

    i. **Contractor's presence at site:-**The Contractor shall give all necessary personal superintendence during the execution of works and as long thereafter, as the Architect may consider necessary until expiration of the "Defects Liability Period" stated in the appendix hereto. The contractor shall also, during the whole time the works are in progress, employ competent foreman approved by the Architect, who shall be constantly in attendance at the building, while the men are at work. Any directions, explanations, instructions or notice given by the Architect to such foreman shall be held to be given to the contractor.

    j. **Gate – keeper and Watchman-** The contractor shall provide and pay at his own expense the wages for the above for the Protection / Security of the works. In case of loss of any material, he will be called upon to replace the same at his own expense.

    k. **The W.C. and Sanitary Accommodation and Office Accessories and Accommodation:** - The contractor shall provide at his own cost and expense, adequate closet and sanitary accommodation for his workmen, for the workmen or nominated sub-contractors and other contractors working in the building, the clerk of works and the Owner, other Agents, connected with this building project and maintain the same in

good working order. The contractor shall also provide at his own expense, adequate office accommodation for the clerk of works/ project engineer (220 Sft) with sanitary facilities & shall maintain the same in satisfactory condition, shall provide lighting for the same and arrange to supply at his own expense, office furniture with drawing accessories for the official use of the clerk of works. The site office accommodation shall be as per the enclosed drawings. The minimum facilities include Site office 200 Sqft and Cement storage 200 Sqft.

l. **Foreman and Tradesmen -** All tradesmen shall be experiences men properly equipped with suitable tools for carrying out all work of carpentry joinery and other trades in a first class manner and where the Architect deems it necessary, the contractor shall provide any such tools special or ordinary, which are considered necessary for carrying out the work in a proper manner.

All such tradesmen shall work under an experienced and properly trained foremen, who shall be capable of reading and understanding all drawings, pertaining to this work and the contractor shall also comply with other conditions set out in the relevant clauses of conditions of contract.

m. **Clearing the site:-** The site shown on the plan and 25feet (8 Metres) all around the building shall be cleared of all obstructions, loose stones and materials, rubbish of all kinds as well as stones and materials, rubbish of all kind as well as brushwood, All th

n. e holes or hollows, whether originally existing of produced by remove of loose stones or brush wood shall be carefully filled up with earth, well rammed and levelled of as directed by the Architect.

o. **Preparation of building works for Occupation and use on completion**:- The whole of the works will be thoroughly inspected by the contractor and all the deficiencies and defects out right. On completion of such inspection, the contractor finished the work and it is ready for Architect's inspection.

On completion, the contractor will clean all windows and doors, including the cleaning with oil, if necessary hardware inside and outside, all floors, staircases, and every part of the building. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Architect.

p. **Weekly Progress Reports: - The contractor shall furnish all particulars, for compiling the progress report in the form provided by the Architect, to the Owner of works.**

q. **Protection, Watching and Lighting: -** Contractor will properly cover up and protect all the works throughout the period of the work until completion, particularly masonry molding, steps, terrazzo or special floor finishes, staircases and balusters, door and window frames, plaster angles, lighting and sanitary fittings, glass, paint work and all finished. In case of renovation/ extension works Temporary staircase with MS railing will have to be provided from yard level to work level, no access to material and labour shall be allowed from existing building before completion and/or certification of Final bill.

r. **Vouchers -** The contractor shall furnish the Architect with vouchers on request to prove that the materials are as specified and also for working out rates of non-bid items.

s. **Rates for Non-Bid Items:-** Rates of items not included in the Schedule of Quantities shall be settled by the Consultant as per contract conditions.

36. **Service gate, site enclosure and labour's toilet :** contractor shall may use the existing gate on the site for material and labour movement. The construction site shall not be strictly used from campus side for material and labour movement. All sides of the construction work shall be cordon off or closed by a barrier using metal sheets minimum 12 feet high. The material entry gate shall be provided with the help of metal sheet which will remain in closed position for nonmaterial movement time. Sheets shall be noncorrosive and in good conditions. Appropriate and good conditioned labour toilet shall be constructed on site for labourers before commencement of the construction activity. **Contractor shall visit the site before filling the tender to understand all the site condition, no claim, relaxation, requirement of additional space for material stacking will not be entertained.**

37. **time frame shall be considered as essence of the this contract and contractor shall strictly adhere to the time frame finalised for the entire project as well as to the interim bench mark for the completion stage as entire period for construction – 03 calendar months. Note- The HVAC work for the Residential Building – Phase I shall be carried out and completed within one month after the construction of the building is completed.**
38. Contractor shall not stack material outside the site. All the stacking of material shall be strictly inside the site. Contractor shall keep all road area and movement area intact and free from material stacking.
39. Contractor shall provide scaffolding works for lift installation as required by particular said vendor as per his requirement of quality, arrangement and time frame. No extra amount will be paid for this to contractor.
40. **No labour camps** will be allowed at site except for watchman paid by contractor. Contractor shall make his own such arrangements outside the site premises (BAR COUNCIL campus).
41. **Toilet on Site:** Necessary labour toilets for gents and ladies' workers separately shall be constructed and arranged by contractor at his own cost.
42. Contractor shall take utmost care to protect waterlines, drain lines [of any scale and diameter] from damaging during construction. If damaged, contractor shall repair it on top priority and urgent basis at no extra cost.
43. All the service connections to municipal mains such as water supply, drainage etc shall be including necessary permissions required for road crossing, cutting etc. no extra claim shall be made by contractor. Contractor shall submit copy of necessary permissions to BAR COUNCIL for their records.
44. If required by client, NDT will be conducted on the built / partially built structure by contractor. The test will be conducted at client's expenses. However any shortfall occurs during the test, or the construction work found defective, it is contractor's responsibility to rectify the same to the satisfaction of the client. All such expenses shall be borne by contractor.
45. During the entire project period and till completion of project contractor shall maintain in good conditions the existing trees on the site irrespective of their size and character. In no condition the damages will be done to the trees. Contractor shall give a written guarantee bond to client regarding this.
46. since time limit for completing the project is given more than adequate , no basic price rate difference will be entertained by client for delayed work , but deduction will be made for the basic rate material of which purchase cost will found lower than the basic rate given in tender .

Order of Precedence of Documents

In case of difference, contradiction, discrepancy, with regard to conditions of contract, specifications, drawings, bill of quantities etc. forming part of contract, the following shall prevail in order of precedence.

I. Letter of award, along with statement of agreed variations and its enclosures, if any.
II. Description of bill of quantity/schedule of quantities.
III. Special conditions of contract.
IV. Technical specifications (general, additional and technical specification) as given in tender documents.
V. General conditions of contract.
VI. Drawings
VII. Relevant BIS codes.

TECHNICAL SPECIFICATIONS

In general, the all the items in the work shall be executed as per the standard specifications mentioned in the State PWD Specification Book (IS 1200) and as per the prevailing norms followed for items not in PWD Specification book and as per the details provided in the Drawings.

TECHNICAL SPECIFICATIONS (FOR INTERIOR WORK)

These specifications are for the work to be executed items to be supplied and materials to be used in the works as shown and defined on the drawings, tender documents and BOQ and described here in all under the supervision and to the satisfaction of the Architect / Employer.

The workmanship is to be the best available and of a high standard. Use must be made of specialist tradesmen in all aspects of the works, and allowance must be made in the rates for doing so.

The materials and items to be provided by the contractor shall be the best of their respective kinds, approved by the architect in accordance with any samples which may be submitted for approval and generally in accordance with the specifications. Where materials or products are specified in these specifications and or / bill of quantities by the name of the manufacture or the brand trade name or catalogue reference the contractor will be required to obtain the approval of the architect / employer before using a material or product other than the specified. The contractor shall produce all invoices, vouchers or receipted accounts for any materials if called upon to do so by the Architect.

Samples of all material are to be submitted to the architect for his approval before the contractor orders or delivers in bulk to the site. Also, the contractor will be required to submit specimen finishers of colours, fabrics etc. for the approval of the architect before according with the works. Should be submitted for the approval of the architect who will retain two copies all at the contractor's expenses.

PARTITIONS AND CABINET WORK

General: Partitions, cabinets, etc. shall be fabricated and assembled in the workshop as far as practicable and then brought inside the building ready to set in place. The various members shall be worked in the best manner known to the trade, mortised and tenoned, doweled, blocked and glued together so as to avoid the use of nails as far as possible. The details shall be closely followed, moulding clearly cut and miters accurately made. Free edge of shutters, shelves, partitions, sides etc. shall be provided with first class teak wood edging, glued and nailed in approved manner or as mentioned in detailed specification. Drawer bottoms shall be of 6 mm commercial ply, unless otherwise shown. Drawer front, sides and back shall be of BWR plywood for thickness mentioned in the detailed specification. The drawers shall slide on SLIDING CHANNELS unless otherwise specified. In partitions 12mm thk BWR ply is to be used to cover the framework.

Preservative treatment: All wood work in contract with masonry shall be painted with approved asphalt or anti termite & fire retardant coating (Viper or equivalent) before placing. Care shall be taken to keep exposed surfaces clear from tar etc. felt shall be used to isolated wood from masonry wherever practicable. All concealed wood etc. shall be treated fully and liberally with so lignum before placing in position Painting and Polishing: All exposed teak faces of partitions, glazing, doors, cabinet work etc. shall be Duco painted/ polished to approve finish. Door shutters, internal faces of cupboards and

cabinets etc. shall be enamel painted to approved finish. Drawer bottoms, sides of drawers, etc. oiling etc. shall be carried out as specified. All the paints & polishes should be of LOW VOC content as per Green building norms

Protection of work: The contractor shall be responsible for the temporary doors and closing in opening necessary for the protection of the work during progress. He shall also provide and maintain any other temporary

a) **TIMBER / WOODWORK** General: Specified variety of timber shall be used in the work. The timber shall be sawn in the direction of grains. The sawing shall be truly straight and square.

i) The hardwood is to be well seasoned Saal, Hollock, Kail, Marandi or other approved similar locally obtainable hardwood weighing 610 Kg/cum.

ii) Teak wood would be of best quality from Burmah, Dandeli, and Balarshah, free from soft heart, worn holes and weighting 640 Kg /cum.

iii) The moisture contents in wood shall be as per the CPWD Specification 1977. The testing of wood shall be carried out as per CPWD Specification 1977.

All Steam Beach wood shall be free from worn holes, soft sap or knots. The wood shall be well seasoned as per IS: 287:1973 with a moisture content of 10%.

i. No individual hard and sound knot shall exceed 6 Sq.cm. In size and the aggregate area shall be more than 1% of the area of the pieces. These shall not be less than 2 growth rings per cm. width in cross-section.

ii. All dimensions given in the schedule of quantities and drawings are the required finished sizes.

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

iv. Grounds are to be clean shown, free large knots, splayed as required, plugged and fixed to walls etc. at 1'6" centres. Wood plugs are to be cut on the twist, patent wall plugs or plastic filling may be used in lieu of wood plugs with the approval of the Architect.

v. All unexposed surfaces of timber e.g. false ceilings, backings fillets backs of doors frames, cupboard framing, grounds etc. are to be treated with two coats of approved timber preservative like solignim, kirticite, term seal or cast oral or vacuum pressure impregnated with and approved water soluble timber preservative before fixing of bedding

vi. JOINTS- All joints will be standard, mortised and tendon, dovetail, do we, cross halved metered tongued and grooved and rebated, nailed or glued but joints, will not be permitted except in exceptional cases, ailed but joints will not be accepted. All joins shall be smeared with white lead.

vii. Whenever solid wood is specified it shall be as per I.S.I. and of good quality. The type of wood shall be got approved before collecting the same on site. Fabrication of wooden members shall be started only after approval. It shall be free from large, loose, dead of cluster knot, flows, shakes, wraps, bends or any other defect. It shall be uniform in substance and of straight fibres as far as possible. It shall free from rates, decay, harmful fungi and other dejects of its usefulness for the purpose for which it is

required. The colour of wood shall be uniform as far as possible. The scantlings planks etc. shall be seen in straight lines and planes in the direction of grain and of uniform thickness.

viii. FIRST CLASS TEAK WOOD: - First class teak wood shall have no individual hard and sound knots, more than 6 sq. cm. In size and the aggregate area of such knots shall not more than 1% area of piece. The timber shall be closed grained

SECOND CLASS TEAK WOOD: No individual hard and knots shall be more than 15 sq. cm. in size and aggregate area of such knots shall not exceed 2% of the area of piece.

COMMERCIAL PLYWOOD

Plywood to be used shall be grade BWR, i.e., it shall have bounded with BWR (Boiling Water Proof) type synthetic resin adhesive shall be equal or superior quality that is laid down in IS: 303-1960.

The veneers for all grades shall be either rotary cut or sliced. The Veneers shall be sufficiently smooth to permit even spread of glue. The thickness of all veneers shall be uniform, within a tolerance 5%, corresponding veneers on either side of center one shall be of the same thickness and species. The requirement of thickness of the face and core veneers shall be as follows:

In 3 ply board upto 5 mm thick, the combined thickness of the face veneers shall not exceed twice the thickness of the center ply.

In a multiply boards, the thickness of any veneer shall not more than thrice the thickness of any other veneer.

The sum of the thickness of the veneers in one direction shall approx. to the sum of the thickness of the veneers at right angles to them and shall not be greater than 1-5 times this sum except for 3-ply as specified in (i).

The moisture content shall not be more than 12.5% by mass. It shall either be of Mafatlal, Kit ply make or other equivalent approved made. Where B.W.P. Grade is specified it should be boiling water proof confirming to I.S. standards.

Plywood should be used after applying white anti-termite liquid. Nails or screws fixed in the plywood should be equally spaced. The plywood sides wherever they are visible should be covered with the beading patti. Too many joints in furniture pieces will not be considered.

Rough finished sides while fitting the fixtures like locks, hinges etc will not be considered.

The contractor will have to make punctures of cut-outs as required by electrical or any other contractor, for which the owner will make no separate payment or by the respective contractor. All contractors will work in team of good spirit and in good faith.

Certain details shall be modified as per the site adjustments.

DOOR SHUTTERS – FLUSH SHUTTERS :

i. All door shutters shall be 35 mm thick flush door solid core type non-decorative Industrial made conforming to IS – 2202 and ISI certified with block board core (confirming to the requirements as per IS-1659), for which the manufacturer shall produce the necessary evidence. The flush shutters shall be made with internal lipping of hardwood 25 mm thick and both faces commercial ply veneered. Adhesive used shall be phenol formaldehyde synthetic resin conforming to BWP types specified in IS-848-1974.

ii. Contractor shall obtain the approval for the name of the manufacturer of the flush door shutters from the Engineer-in-charge before placing the supply order. While asking for the approval, copy of the

"Bureau of Indian Standard" letter under which manufacturer has been authorized to mark the product with ISI marking should be attached. Engineer-in-charge, before giving the approval shall ensure that the validity date of license has not expired.

Testing of Flush Door Shutters:

On receipt of the shutters at site, the Engineer-in-charge shall be entitled to get the samples of door shutters tested in any approved laboratory. From each lot of shutters, one shutter shall be selected at random by the Engineer-in-charge. The cost of the door shutters selected as samples, their transportation to the laboratory and cost of testing by the laboratory shall be borne by the Contractor and paid by Shri Mahavira jaina Vidyalaya,in running and final bill.

REBATING: The shutters shall be single leaf or doubled leafed as shown in the drawings and as directed by Engineer-in-charge. In case of double leafed shutters, the meeting of the stiles shall be rebated by one third the thickness of the shutter.

- On all door shutters, laminate, 1/1.5 mm th.shall be pasted with adhesives as specified by the manufacturers. The laminate shall be as per approved shade & texture, of make
- The bottom of shutters shall be 5mm above the finished floor level.
- Wherever stainless steel sheeting as a strike plate is mentioned, it shall be pasted with SR 198, along with SS stud screws @ 200 c/c, 50mm inside of all edges. This shall be pasted upto the bottom 1350mm ht. or as shown in the drawing. The SS sheet shall be 0.5 MM th.A sample of a single leaf as well as a double leaf shall be made and got approved from the Engineer-in-charge before ordering mass production. The sample, once approved shall be retained in the approved materials store under the supervision of the Engineer-in-charge.
- Vision panel, wherever needed shall be 5/5.5mm. th.plain glass of the size as mentioned in the drawings. The panel shall be fixed within the cut-out made from within the door shutter. The cut edges shall be fixed with TW lipping 35 x 8mm. The lipping shall be flushed with the outer edges of the door and the glass fixed in the center of this lipping with quarter round beadings, 15x15 mm.

- **LAMINATES**

All the laminate to be used shall be of 1/1.5 mm thickness in approved the colour and shade as proved and specified by the architect

Joints in the laminates will not be permitted until and unless the same is unavoidable or is required as per the drawings

It shall be matt finish manufactured by Greenlam / Formica India Ltd or as mentioned in the list of approved makes. Or its equivalent as per the sample shown by the Consulting unless otherwise specified. It shall satisfy all the I.S.I. standards for melamine coated laminated fibre boards contractor shall have to take approval of the Department for each sheet of the laminates.

- **FASTENINGS AND HARDWARE:** Extent and intent: The intention of the contract is that that the building as shown shall be completely equipped with required hardware. Any required item not noted or listed shall be finished in a grade equal to and in harmony with similar item listed.

General: All hardware shall be of the best quality of its type and strictly in conformity with the materials and finish described in schedule of hardware. If called upon to do so, the contractor shall arrange to get hardware specially manufactured to the design, requirements and standards laid down by the Architect.

Samples: Samples of each different item of hardware including screws or any particular item of hardware shall be submitted to the Architect for approval.

Quality: All hardware shall be of perfect fit, uniform in finish and free from imperfections that affect serviceability or mar the appearance.

Guarantee: The contractor shall be responsible for the proper working of all hardware, for a period of one year from the date of completion of acceptance of the building.

The fixtures and fastenings, that is, butt hinges, teemed strap hinges, sliding door stoppers, casement window fasteners, casement stays and ventilators, Handles, Sliding channels catch shall be made of the metal as specified in the item or its specifications.

They shall be of Stainless Steel, iron, brass, aluminium, chromium plated iron, and chromium plated brass copper oxidized iron copper oxidized brass or anodized aluminium as specified.

The fixtures shall be heavy type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure case of operation.

The samples of fixtures and fastenings shall be got approved as regards quality and shape before providing them in position.

Brass and anodized aluminium fixtures and fastenings shall be bright finished, SS fixtures to be finished as mentioned in the specifications.

Screws, nails, bolts will be of brass or other non corrosive metal. In hardware, they will match the finish of the hardware item.

Nails, in a finished surface shall be neatly punched and the hole filled with wood filler matching the finish. Screws, in a finished surface will be round head, raised head or sunk beneath the surfaces and the hole plugged with a wood plug with matching colour and grain of the wood surface, unless especially detailed.

- **HARDWARE:** Hinges, locks, latches, door tracks etc. shall be as specified by the manufacture specified. In a variation of this quality of the substitute shall be equal to or better than the original specified, and samples should be submitted to the Architect for prior approval.
- **HARDWARE AND METALS: -**The hardware throughout shall be of approved manufacture and supply well made and equal in every respect to the samples to be deposited with the Architect. The contractor any be required to produce and provided samples from many different sources before the Architect is able to make a decision and he should allow in his rates for so doing.

Fittings generally shall have SS brush finish unless otherwise specified, and shall be suitable for their intended purposes.

Screws are to match the finish of the article to be fixed and to be rounded of flat headed or counter sunk as required.

Cover up and protect at the brass and bronze surfaces with thick grease or other suitable protective material, renew as necessary and subsequently clean off and clear away on completion.

Aluminium and stainless steel 304/316 shall be of approved manufacture and suitable for its particular application. Generally the surfaces of aluminium shall have an anodized finish and both shall comply with the sample approved the Architect.

All steel brass, bronze, aluminium and stainless steel articles shall be submitted to a seasonable test for strength; if so required by the Architect at the Contractor's expenses.

All brazing and welds are to be executed in a clean and smooth manner rubbed down and left in the flat test and tidies way, particularly where exposed.

Chromium plated shall be in accordance with B.S. 1224 or as per approved specification and shall be on base materials of copper or brass or as specified by Architect.

SS fittings shall be in accordance with IS ---- and as per specifications

Adhesives – Adhesive shall be Phenol Formaldehyde Synthetic resin conforming to

B.W.P. (Boiling Water Proof) type specified in IS: 848-1974. Only synthetic resin adhesive shall be used for bonding cores members to one another, including core frame, and for lipping, glazing frame, Venetian frame and other exposed parts where such binding is done.

Nails, spikes, screws and bolts - Nails, spikes and bolts shall be of the best quality mild steel or wrought and of length and weights approved by the Architect. Nails shall comply with IS: 1959-1960 or equivalent approved quality samples. Bolts with I.S. or equivalent approved quality samples. Brass headed nails are to comply with B.S. 1210. Wire staplers shall comply with B.S.1494 or equivalent.

- **GLASS :-** glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes, blisters and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of glass panel shall be uniform. All glass to be approved manufacture complying with IS: 3548-196 or as per approved quality and sample.

  The compound for glazing to metal is to be special non hardening compound manufacture for the purpose and of 9 brand and quality approved the interior Designer.

  In cutting glass, proper allowance shall be made for expansion. Each square of glazing to be in one whole sheet and after cutting the edges to be properly filled.

  All cracked, scratched and broken pane should be replaced. All glass surfaces should be properly cleaned inside out.

- <u>PAINTING</u>

  Extent and intent: The contractor shall supply all materials, labour, tools, ladders, scaffolding and other equipment necessary for the completion and protection of all painting work. Painting, as herein specified shall be applied to all surfaces requiring painting throughout the interior and exterior of the building as given in the schedule of finishes or elsewhere. Care is to be taken that all surfaces to be painted are thoroughly cleaned and dry.

  Materials: Materials used in the work shall be of manufacture approved by the Architect/Employer. Ready mixed paints, varnishes, enamels, lacquers, stains, paste fillers, distempers and other materials must be delivered to the job site in the original containers, with the seals unbroken and labels intact. Each container shall give the manufacturer's name, type of paint, colour of paint and with unbroken seal and instructions for reducing the thinning shall be done only in accordance with directions. Remove rejected materials immediately from the premises. All brushes tools. Kettles etc. used in carrying out the work shall be clean and free from any foreign matter. All paint material shall be stored in cool, dry conditions clear of other stores. The mixing of materials of different brands or during application shall not be permitted

  Colour: All colours, as provided in the colour schedule shall be approved by the Architect/Employer. The contractor shall mix manufacturer's colours as per Architect's/ Employer's requirements and shall prepare painted samples of the colours selected and submit same for approval by the Architect. No work

is to proceed until the Architect has given his approval, preferably in writing of the colour samples. Ready mixed paint shall be used exactly as received from the manufactures and generally according to their instructions and without any admixtures what so ever

Commencement of work: Painting shall not be started until the surfaces to be painted are in a condition fit to receive painting and so certified by the Architect. Painting work shall be taken in hand only after all other contractor"s work is completed. Building where painting work is to be commenced shall be thoroughly swept and cleaned up before commencement of painting.

All the paints shall meet with the following general requirements

Paint shall not show excessive setting in a freshly opened full can and shall easily be predisposed with a paddle to a smooth homogeneous stage. The paint shall show non curdling levering caking or colour separation and shall be free from lumps and skins.

Paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.

The paint shall not skin within 49 hours in a three quarters filled closed container.

The paint shall dry to a smooth uniform finish from the manufactures and generally according to their instructions and without any admixtures what so ever.

White Wash / Dry distemper

White wash shall be provided to over plastered surfaces, if any, as directed by Project Manager and Architect.

Dry distemper of approved shade shall be provided to all internal surfaces of all rooms including toilets and kitchen etc. all as directed by Project Manager and Architect.

Before application of white wash / distemper the surfaces shall be prepared to clean and even surface.

White wash shall be prepared from lime slacked on site, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for 24 hours and shall be screened through clean cloth. Four kg. of gum dissolved in hot water shall be added to each cubic meter of the cream (115 gm/cft). Blue shall be added to give required whiteness. The approximate quantity of water to be added in making cream shall be five liters per kg. of lime. 10% Zinc Oxide shall also be added to obtain a desired shining in the white wash.

Dry distemper shall be carried out in two or more coats over one coat of approved primer as per manufacturer's instructions to give even shades.

White wash and dry distemper shall be applied in specified coats by using flat brushes or spray pumps. Each coat shall be allowed to dry before next coat is applied, if additional coats than what have been specified are necessary to obtain uniform and smooth finish it shall be given to no extra cost.

The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed.

All paints have to be low VOC paints and certificates of the same should be provided by the bidder.

CEMENT BASE PAINT

Two or more coats of cement base paint shall be applied to give even shade on all external cement plaster, internal plaster surfaces or parapet surfaces. Soffits of chajja, lintels, beams and sills of external windows. The shades of paint shall be used as approved by the Engineer-in-charge. Each coat shall be cured well by wetting surfaces for at least three days.

Alternatively, white cement slurry shall be used with pigment as required to achieve the desired shade. The white cement slurry shall be such as to provide a spread of 15 Sq.M per bag (50Kg) of white

cement.

For all external paints, a patch at least 10 Sq.M. in area has to be done and got approved form the Engineer-in-charge for quality, shade & texture.

ACRYLIC EMULSION PAINT

These paints are to be used on External surfaces except wooden and steel. Plastic emulsion paint as per IS : 5411 of approved brand and manufacture and of the required shade shall be used.

PLASTIC EMULSION PAINT: Pigmented priming cost (emulsion thinned with water) followed by three or more finishing coats of plastic emulsion paint. Pasted filter to be applied every coat exempting the final finishing coat and sanded.

Painting on New Surface

The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer- incharge after inspection, before painting is commenced.

Application: The number of coats shall be as stipulated in the item. The paint will be applied in the usual manner with brush, spray or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces.

The thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the under coat which is applied on the absorbent surface. The quantity of water to be added shall be as per manufacturer"s instructions. The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

Precautions:

Old brushes if they are to be used with emulsion paints should be completely dried of turpentine or oil paints by washing in warm soap water. Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

In the preparation of wall for plastic emulsion paintings, no oil base putties shall be used in filling cracks, holes etc.

Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

Washing of surfaces treated with emulsion paints shall not be done within 3 to 4 weeks of application.

NOTE

The specifications of the various items of the works will be as per latest editions of PWD/CPWD specifications for work with all correction slips. In absence of any detailed specifications in PWD/CPWD, latest Indian Standard specifications and code of practice shall become applicable.

Wherever, these codes are silent, the same shall be governed by sound engineering practice and the decision of EIC in matters of interpretations etc. shall be final and binding on the Contractor. In case of the material supplied by the specialized agencies the material specifications of the same agencies shall be made available with their address and telephone No. by the contractor and shall be used as per the same specification and as per the direction of EIC. If required the contractor shall arranged the inspection/ verification of the items from the Engineer of the expert agency. Item wise detailed technical specifications may be described in the tender to correlate with drawings and BOQ

Polishing works -The wooden article to be polished shall be first prepared to smooth surface with 400 fit black water proof sand paper. All dents shall be filled with epoxy putty and to be finally finished with DUCO, N. C. clear lacquer to a silky smooth finish.

The basic material shall be shellac dissolved in methylated spirit. The timber must be well sanded and cleaned and the grain, filled with grain filler. Any stating must be done before applying the polish. Work evenly over the surface with slow figure of eight motion until the timber is coated with a thin layer of polish. The object is to apply a series of thin coats allowing only few minutes for drying between the two coats. When a level and even bodied surface is obtained the work is ready for spiriting off. Allow the work to stand for at least eight hours, then take a fresh rubber with a double thickness of cover material and charge it with methylated spirit. The object of spiriting off into is to remove the rubber marks and to give the brilliance of finish.

Any polish or paint spot marks etc. on flooring tiles should be cleared by the contractor before handling over the site

Spirit polish

Polish: Polishing material shall be prepared by dissolving pure shellac, varying in shade from pale orange to lemon yellow, free from direct and other materials, in methylated spirit at the rate of 0.15 Kg. shellac to 1 litter of spirit. Suitable pigment to achieve the required shade of polish shall be added as directed by the Architect.

Preparation of Surface: The surface, cleaned of all dirt etc. shall be rubbed down smooth with sand paper and well dusted. Knots if visible shall be covered with a preparation of red lead and glue size laid on while hot. Holes and indentations shall be given a coat of wood filler made by mixing whiting (ground chalk) in methylated spirit at the rate of 1.5 Kg. of whiting to one litter of spirit. The surface shall again be rubbed down perfectly smooth with fine sand paper and wiped clean.

Application: Three or more coats of polish shall be applied over the above surface, to achieve a finish as approved by the Architect. The polish shall be applied with a pad of woolen cloth covered by a fine cloth. The pad moistened with polish shall be rubbed had on the wood surface in a series of overlapping movements, applying the material uniformly over the entire area to give an even finish. Subsequent coats shall be applied in similar manner after the previous coat is allowed to dry. The finishing shall be done with fresh piece of clean fine cloth, damped with methylated spirit and applied by light rubbing. The finished surface shall have a uniform texture and high gloss.

Wax Polishing

Preparation of Surface: The surface to be polished shall have been finished smooth. Knots, cracks and holes on the surface shall be cleaned and filled with wood putty (fine saw dust mixed with bees wax). The fillings when dry shall be rubbed down with a carpenters file and then the entire surface shall be rubbed down perfectly smooth and wiped clean. In no case shall sand papers be rubbed across the grains so that even fine marks are not seen on the surface.

Application: The polish shall be applied evenly with a clean soft pad of cotton cloth in surface is completely and fully covered. The surface is then continuously rubbed till the surface is quite dry. A second and third coat shall be applied in the same manner and rubbed continuously until the surface is dry. The final coat shall then be applied and rubbed until the surface has assumed a uniform gloss and is dry, showing no sign of stickiness. The finished surface shall have a uniform flossy finish as approved

by the Architect.

MELAMINE FINISH

The Melamine finish shall be applied on the French spirit polished surface.

The melamine coat preferable of clearly hard glaze shall be applied with a cloth Pad. The surface shall then be left to dry for at least six hours and further coats are applied with a paint brush. If the duration of gap is more than 24 hours between coats, the previous coat shall be rubbed down with a fine glass paper or a medium grade of steel wool. The matt finish shall be obtained by giving a final coat of clean reseal matt coat.

FALSE CEILING

Aluminum / GI perforated Metal Ceiling system

The metallic ceiling shall have regular beveled/plain edge powder Coated aluminum / GI ceiling tiles In size 600mm x 600 mm x 0.6 mm & color RAL 9003 white & having perforation of 1.8 dia circle with a backing of factory pressed black non woven tissue the epoxy powder coat should electro statically be applied in a controlled environment and then be baked to achieve the perfect fusion with the metal surface to be laid on to be exposed grid system 24mm comprising main runner, cross tees and wall angles. for installation to comprise intermediate channel of size 45mm x 0.55mm thk with two flanges of15mm each suspended at 1200 mm clipped to spring runner, bracket and connectors for spring runners securely fixed to structure using GI soffit cleats fixed to ceiling with 6mm dia and 50mm long dash fasteners, 4mm GI adjustable rods with galvanized level clips spaced at 1200mm center along with the runner by approved suspension and bracket and connectors for spring runners. Wall angles 19mm X 22mm with clips to be secured to the wall at 450mm maximum center to the successful completion of the job to the satisfaction of the Engineer-in-charge. The rate shall be inclusive of making openings for light fittings, grills, diffusers, cutouts, wastage and necessary hardware etc

Demountable Aluminum Ceiling The ceiling should be laid in true horizontal level with Concave and Convex demountable ceiling panels made of aluminum of nominal size 600mmx900mmx1.0mm (actual size: 607x911x1.0mm) having a perforated (micro perforation with 2.5mm dia holes and 22% open space and 12.8mm border) surface and having Fire Performance CLASS A (ASTM E 84) and an NRC of 0.7suitable for Green Building application, with Recycled content of 50%. The tile shall have colour as per approval and acoustical fleece glued to the back of the tiled shall be laid on hook-on grid systems with hook-on (J-bar) carriers and Alignment (spacer) bars suspended from the structural soffit using a system of threaded rods. The rate shall be inclusive of making openings for light fittings, grills, diffusers, cutouts, wastage and necessary hardware etc all complete as per Engineer-In-charge at site.

Alignment bars will be spaced at every 1200 mm intervals secured to the structural soffit using 6mm (M6) threaded rods in a direction parallel to the length of the curved panels. The hook on carrier bars shall be secured perpendicular to the alignment bars using rivets or nuts at every 911mm intervals. The concave and convex curved panels shall be placed alternatively on the hook-on bars and secured by the special tabs provided on the hook-on carriers. Special perimeter trim (optional) may be fabricated to conceal the carrier bars in the shorter direction of the panel. The rate shall be inclusive of making openings for light fittings, grills, diffusers, cutouts, wastage and necessary hardware etc.

- GENERAL SPECIFICATION FOR CIVIL WORK.

I CONCRETE CONSTRUCTION

1.1. Scope :- This section of the specification shall apply to all concrete works to be carried out under the contract including batching, supply, delivery, handling, placing and curing of concrete, erection and dismantling of formwork and supply, bonding, handling and fixing of reinforcement.

Reinforced concrete unless varied by this specification shall comply with the requirements of the latest Indian Code Requirements for Plain and Reinforced Concrete IS 486: 1978, its amendments and other relevant codes stated herein.

All materials used shall be of the best quality obtained from sources and suppliers approved by the Consultant and shall comply strictly with the tests prescribed herein or, where tests are not laid down in this Specification, with the requirements of the latest relevant Indian Standards outlined herein or other Standards approved by the Engineer.

Materials

1.1.1. Cement

1.1.1.1. Cement shall be ordinary Portland Cement conforming to IS 269 - 1989 unless specified differently. It shall be received in bags of 50 kg and each batch shall be accompanied by a factory test certificate. It shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 6 months or for any reasons, the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Consultant prior to use in the works.

1.1.1.2. Cement shall be stored to prevent deterioration due to moisture/dampness. Bags shall be stacked on rigid water-proof platforms with about 15 to 20 mm clear above the floors and with 25 to 35 cm clearance from the surrounding walls. Maximum stack height is 12 bags. Stacks shall be so arranged that the first batches are used first (FIFO) and for easy access for inspection and handling.

1.1.1.3. The following other types of cement may be used in works if specified or with the prior written approval of the Engineer in writing for specific purpose. Any additional cost for the use of these cements unless requested by the Consultant, shall be to the expense of the Contractor. Specialist literature shall be consulted for guidance regarding use of these types of cement.

1.1.1.3.1. Rapid hardening portland cement conforming to IS 8041 - 1990.

1.1.1.3.2. Portland pozzolana cement conforming to IS 1489 - 1991.

1.1.1.3.3. High strength ordinary portland cement conforming to IS 8112 - 1989.

1.1.1.3.4. High alumina cement conforming to IS 6452 - 1991.

1.1.1.3.5. Supersulphated cement conforming to IS 6909 – 1990

1.1.2. Aggregate

1.1.2.1. Alkali Silica Reaction of Aggregates

Any aggregate source of an extrusive volcanic origin shall be tested for alkali silica reaction (ASR) by a test procedure acceptable to the Engineer before it is accepted for inclusion in the works. Aggregates from any source known to be alkali silica reactive shall not be included in the works. If at any time during the works the aggregates are sourced from other than approved sources, the new source material shall be tested for ASR before it may be approved by the Engineer for inclusion in the works.

The cost of all such testing shall be borne by the Contractor.

1.1.2.2. Coarse Aggregate

(a)Coarse aggregate shall be obtained from approved quarries and may be crushed or uncrushed, or a combination thereof. Aggregate shall be hard, strong, dense, durable, clean and free from veins and adherent coatings. It shall be free from soft, friable, thin, elongated or laminated pieces and shall be roughly cubicle in shape. It shall consist of coarse material, most of which is retained on 4.75 mm IS sieve.

(b)Coarse aggregate shall not contain any harmful material such as iron, pyrites, coal, mica, shale or similar laminated material; neither shall it contain clay, alkali, soft fragments, sea shells, organic impurities, etc. in such quantities that adversely affects the strength and durability of the concrete. In addition to the above, in reinforced concrete the aggregate shall not contain any material which might attack the reinforcement. The maximum quantities of deleterious materials in coarse aggregate, when determined in accordance with IS:2386 - 1963 Part I and Part II " Method of test for aggregates for concrete" shall not exceed the limits laid down in Table 1 of IS: 383-1970.

(c)Aggregate crushing value, impact value, abrasion value and soundness shall be respectively in accordance with Section 4.3, 4.4, 4.5 and 4.6 of IS 384 - 1979.

(d)Grading of coarse aggregate shall be in conformity with the requirements laid down in IS:384 - 1979. (Table 2 and 5).

(e)Aggregate shall be sourced from an approved Government location. It shall be tested prior to the approval by the Consultant by an approved testing laboratory. In case available aggregates do not meet certain requirements of IS 383 - 1970 or any other specification, the required processing shall be carried out by the Contractor at his cost. No extra cost towards these processes or treatments shall be paid by the Employer.

(f)It shall be the duty of the Contractor to make sure that all aggregate material received by him is from Government approved quarries and that all with fully paid royalties, taxes, duties, etc. as may be in force from time to time for respective locations.

(g)Aggregate shall be stored in such a way that it does not contaminated by with mud, grass, vegetables and other foreign matter.

(h)Coarse aggregate shall have a minimum specific gravity of 2.6 (Saturated surface dry basis). Aggregate below this specific gravity shall not be used without the special permission of the Consultant.

(i)Once a specific source of supply of coarse aggregate is approved, the source shall not be changed without the prior approval of the Consultant.

(j)Grading limits for single sized coarse aggregate (IS : 383),

Normal size of aggregate	Passing sieve %							
	80 mm	63 mm	40 mm	20 mm	12 mm	10 mm	4.75	2.36
63 mm	100	85-100	0-30	0-50	-	-	-	-
40 mm	-	100	-85-100	0-20	-	0-5	-	-
20 mm	-	-	100	85-100	-	0-20	0-5	-
12 mm	-	-	-	100	85-100	0-45	0-10	-
10 mm	-	-	-	-	100	85-100	0-20	-

(k)Limits for use of single sized coarse aggregate in various types of structures:

Use	Size
Slab & walls 200 mm or more in thk.	40 mm to 10 mm
Column & girders with least dimensions of 300 mm or more.	40 mm to 10 mm
Slab & walls under 200 mm in thk.	20 mm to 10 mm
Column & girders with least dimensions under 300 mm.	20 mm to 10 mm

1.1.2.3. Fine Aggregate

Natural sand is the most preferable source of fine aggregate.

(l) Crushed and screened stone may be used but care will be required to ensure that it is free of excessive dust and clay. Flaky and angular particles are to be avoided.

(m)Sea sand should not be used unless approved by the Consultant. If approved, all required treatment shall be done at the Contractor's cost.

(n) Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica, shale or similar laminated material, alkali, and organic impurities in such form or quantities as to affect the strength or durability or concrete or mortar. It must not contain any material liable to attack the steel reinforcement.

(o) When tested as per IS:2386 - 1963 Part I and Part II, fine aggregate shall not exceed permissible quantities of deleterious materials as give in Table 1 of this code.

(p) If necessary fine aggregate shall be thoroughly washed with clean fresh water such that the percentage of all deterious materials is reduced permissible limits. The cost of washing is to be borne by the Contractor.

(q)Grading of fine aggregate shall fall within the limits of one of the four zones given in Table 4 of IS:383 - 1970.

(r)Due allowance is to be made while preparing mixes based on volume measurements for bulking. Bulking shall be determined as per Appendix A of IS:2386 - 1963 Part III.

(s)Storing of aggregate shall be as per 3.2.3.2 f).

(t)Grading limits for fine aggregates:-

I.S. Sieve Designation	Equivalent B.S Sieve No.	Natural sand or Crushed gravel sand	Sand
4.75 mm	3/1600	90-100	90-100
2.36 mm	No. 7	75-100	60-95
1.18 mm	No. 14	55-90	30-70
600-micron	No. 25	35-60	15-35
300-micron	No. 52	5-30	5-20
150-micron	No. 100	0-10	0-12

(u)Limit for impurities in Aggregates (IS : 383)

Test	Fine aggregate	Course aggregate
Clay, silt & fine dust in natural sand or crushed gravel (by weight)	4%	1%

Organic impurities: The solution obtained by immersing the sample in 3% solution of sodium hydroxide for 24 hr. should be light color. Coarse & fine aggregate shall be batched separately.

1.2. Water

Water used for mixing and curing shall be clean, reasonably clear and free from excessive quantities of silt, oils, alkalise, acids, salts. It shall be free of elements, which significantly affects the hydration reaction or otherwise interfere with the hardening of concrete during curing, or those elements that produce objectionable stains or deposits. Potable water is generally satisfactory but it shall be tested prior to use in the works. Sea water shall not be used for either batching or curing.

Water testing shall be in accordance with IS :3024 - 1964. Maximum permissible limits of deleterious materials in water shall be as given in IS: 456 - 1978 (Table 1).

The suitability of water shall be further ascertained by the compressive strength and initial setting time test as specified under :

a) Average 28 days compressive strength of at least three 150 mm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar blocks prepared and tested in accordance to IS: 516 - 1959.

The initial setting time of test cubes made with proposed cement and water, shall not be less than 30 minutes and shall not differ by ± 30 minutes from the initial setting time of control test block prepared with the same cement and water. Preparation and testing of cubes shall be in accordance with IS :4031 - 1988.

The PH value of water shall not be less than 6 or more than 9.

Water storage tanks shall be such as to prevent the inclusion of any deleterious materials.

Water shall be tested and approved in writing by the Consultant prior to use in the works.

1.3. Admixtures

These are substances other than cement, aggregate and water that may be permitted to be used to modify the properties of concrete for single, or a combination of purposes. Admixtures shall be used only on the written approval of Consultant for specific purpose and at the cost of the Contractor. Admixtures generally in use are classified as:

- Accelerators
- Retarders
- Workability agents
- Water repelling agents
- Air-entraining agents
- Gas-forming agent

These are manufactured and sold by various companies under brand names. The Contractor proposing to use any of them shall submit to the Consultant technical literature including chemical composition, reason for use, and method recommended by the manufacturer and what site controls are intended to ensure compliance with the proposed methodology.

The Contractor's proposal to use an admixture shall include the following:

a. The trade name of the admixture, its source and the manufacturer's recommended method of use;

b. Typical dosage rates and the possible detrimental effects of under and overdosage;

c. Whether the admixture contains chloride in any free form or any other chemical present as an active ingredient which is a likely cause of corrosion of reinforcement or deterioration of concrete; and

d. The average expected air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the manufacturer's recommended rate of dosage.

1.4. Concrete

Concrete shall be designed and produced so that the following parameters as specified in the relevant codes are met.

All slump testing shall be carried out at the workplace.

Concrete Use	Compressive Strength (MPa)	Slump (mm) ±15	Minimum Cement Content (kg/m^3)	Maximum Water Cement Ratio
P.C.C.	M10	120	285	0.46
P.C.C.	M15	60	310	0.45
R.C.C.	M20	75	340	0.44
R.C.C.	M25	75	390	0.43
R.C.C.	M30	60	410	0.42
R.C.C.	M35	57	450	0.41
R.C.C. Slab, refuge slab, R.C.C. lift walls, beams, deep beams, columns, parapet walls, staircase	M40	55	490	0.40

1.4.1. Cement Concrete

This shall be classified as plain cement concrete or reinforced cement concrete. Plain cement concrete (PCC) shall be used in levelling course under foundations, floors, copings, etc. and shall include formwork as part of the work.

Reinforced cement concrete shall be used in all structural elements and comprises formwork, reinforcement and concrete.

Concrete shall be classified by its 28 day compressive strength. The concrete grades shall be as designated in Table 2 of IS 456 - 1978.

1.4.2. Design Mix

It shall be the responsibility of the Contractor to get the mix designed by appointing an agency duely qualified for the same by sending material samples & other relevant data to them and should submit the detailed report of mix design to consulting Architect for approval. This procedure shall be repeated for every change in material source. It is also the responsibility of the contractor to carry out design mixes. Approval for of the same shall be obtained from the Consultant at least 56 days in advance of the actual placing of concrete at site in the permanent works.

The basic aim of mix design shall be to find the most economic proportion of cement, aggregates, and water which will give the desired strength of concrete, proper workability and durability (Severe as per I.S. 456 appendix). Also it is important that the mix should be easily worked with the use of equipment available on site. The operations involved at site include measurement of material, mixing, placing, compacting, finishing and curing. The design shall be carried out strictly to IS specification and IS code of practice 456, SP 23 and SP 24. The Contractor must ensure that the minimum cement content per cubic meter of reinforced concrete is not less than that stipulated in Section 3.5.

1.4.3. Trial Mix

i) As stated above in clause 3.5.2, the Contractor shall submit, at least 56 days in advance, to the Consultant the mix design that he proposes to use at site. The mix design shall also give basic details (When tested according to IS 1199 - 1959 and IS 2386 -Part III 1963), such as

a) Mix Designation Mark.
b) Grade of Concrete.
c) Type of Cement.
d) Maximum nominal size of aggregate.
e) Proportion by weight of individual ingredients and total weight of batch.
f) Water cement ratio
g) Type of aggregate
h) Admixture and quantity
i) Slump
j) Target strength
k) Cement manufacturer
l) Quality Control Measures
m) Bleeding
n) Compacting Factor
o) Vee-Bee Time.

ii) On receipt of this, the Consultant may immediately order trial mixes before the final approval is granted. This shall be done with the mixer and materials actually being used at site.

This shall give the Contractor additional chance to check the actual workability and make sure that the proposed mix by him will be satisfactory with regards to slump, segregation, bleeding, water-cement ratio and workability.

Six cubes shall be taken from each of 3 test mix batches. Cubes shall be cast, stored, cured, transported and tested to IS 516 - 1959. The test may be carried out at site or a laboratory as approved by the Consultant.

Trial mixes shall be approved provided that the average strength of 3 consecutive cubes is not less than that specified and if no cube gives a value of less than 90% of the specified strength.

iii) In case the trial mix fails the above criteria, the Consultant shall order fresh trial mixes to be made, until the desired strength is arrived at.

iv) If a material source(s) or quality is changed the Consultant may order fresh design mix and trial mixes to be carried out before the same is used at site.

v) It is the responsibility of the Contractor to prepare and get the cubes tested and to provide for all material, labour, moulds, equipment, casting and curing facilities, charges for testing, etc.

The Contractor shall provide and maintain a site laboratory with necessary equipment and staff to carry out the following tests.

- Grading of coarse and fine aggregates;
- Silt content of sand;

- Moisture content of coarse and fine aggregates;
- Concrete cube test and
- Slump test of concrete;

The Contractor shall maintain full records of all tests in a register. The format of records shall be prepared in consultation with the Consultant. The Consultant shall at all times have full access to the Contractor's laboratory and test records.

The Contractor shall include charges for the above work in his rates and no extra whatsoever shall be admissible on this account of designing, testing, maintaining laboratory, etc.

The contractor is entirely responsible for the design of the concrete mixes. The design is however to be approved by the Engineer before commencing any concreting in the works. The Contractor shall make trial mixes using samples of coarse aggregates ; sand, water and cement, typical of those to be used in the works, and which have been tested in an approved laboratory. A clean dry mixer shall be used and first batch discarded.

Table – 1

Grades designation at	Char. Strength fck at 28 days	Estimated min. cement content	Target avg. strength at 7 days	Target avg. strength at 28 days
M 10	100	225	100	140
M 15	150	300	150	210
M 20	200	350	195	275
M 25	250	400	235	335

In case however the Contractor is unable to obtain the required average strength with these cement contents he will be required to provide increased cement content at his own cost. On the other hand, cement contents less than the estimated minimum are not permitted.

Where the mix is not designed following proportion shall be used for concreting (by volume)

M 10	1:3:6
M 15	1:2:4
M 20	1:1 ½ : 3
M 25	1:1:2

R.C.C. Works in Controlled Concrete:

Strength of concrete of different grades and their proportions for Controlled Concrete shall be as under:

Grade of concrete	Specific characteristic compressive cube strength At 28 days in kg/sq. Cm	Total qty. by weight	Proportion of fine Dry aggregate to course aggregates (Course aggregates + 50kg cement)	Qty. of water per 50kg. (Lit)
M – 5	50	800	Generally 1:2 but subject to upper limit 1:1 – 1/ 2 & lower limit 1:2 – 1/2	60
M – 7.5	75	625		45
M – 10	100	480		34
M – 15	150	350		32
M – 20	200	300		30

Grade of concrete	Specific characteristic compressive cube strength At 28 days in kg/sq. Cm	Total qty. by weight	Proportion of fine Dry aggregate to course aggregates (Course aggregates + 50kg cement)	Qty. of water per 50kg. (Lit)
M - 25	250	250		30

Note :M – 5 and M – 7.5 grades need not be designed for mixes.

(v) Coarse aggregate above means graded coarse aggregates.

(w) If for obtaining workability etc., the quantity of water has to be increased, then the cement content shall also be proportionately increased so that specified water cement ratio is not exceeded. The cost of such extra cement shall be deemed to be included in the item rates/prices.

Not withstanding the mix design prepared by the Contractor, the absolute minimum quantity of cement, which must be used for various grades or concrete, shall be as follows :

Mix	Kg. per Cu. Mr. (OPC) or (PPC)
M : 15	300
M : 20	350
M : 25	400

1.5. Supply of Concrete

1.5.1. Approval of Source

Concrete supplied for the contract shall be either ready mixed concrete from a recognised supplier or from a batch plant established on site. At least 56 days prior to any concrete being required, the Contractor shall seek approval from the Consultant for both the supplier and their plant or the Contractors own proposed batching plant.

Submission for approval of on site batching shall be made to the Engineer 56 days prior to any concrete being used. The submission shall be accompanied by:

- Details of the proposed material storage arrangements on site;
- Details of the proposed batching and mixing methods;
- Details of the proposed material sources;
- Details of the proposed transportation method; and
- Any other information which the Consultant deems necessary.

1.5.2. Batching

All mixing and batching operations shall be carried out in accordance with the relevant codes.

The concrete shall be proportioned in the following manner: cement by weight, aggregates by weight, water by volume and admixtures by volume.

The cement shall be weighed in a hopper separately from the aggregates. The batching plant shall be so designed that materials flow efficiently and freely from bins to weighing hoppers. Means of control shall be shut off with precision. Weighing hoppers shall discharge efficiently so that no more than 0.25 percent of batch weights shall be retained in the hopper in the case of aggregates and no more that 1 percent in the case of cement.

Allowance shall be made for the water contained in the aggregates when calculating the quantity of water to be added in the mix.

The Contractor shall provide concrete batch mixers, vibrators, weigh batches conforming to relevant IS specification. The capacity and number of mixers and vibrators required at site from time to time shall be to the approval of the Consultant. No equipment from site shall be removed without the prior written approval of the Consultant. The Contractor shall also maintain a platform weighing scale of capacity 300 kg with fraction up to 100 gms at the site.

As directed by the Consultant, a weekly or periodic calibration of all machines shall be done and records of these calibrations shall be maintained in a register.

Regular maintenance of machinery shall be carried out on a weekly basis or as directed by the manufacturer of machines.

1.5.3. Mixing

The concrete shall be mixed in a mixer of adequate capacity complying with the requirements of IS:4952:1968 and having a power elevated loading hopper. The quantity of water added to each batch in the mixer may be varied by not more than + 5% in order to maintain a constant workability. The mixing shall continue until there is a uniform distribution of the materials and the mass is uniform in colour and consistency and in no case shall the time of mixing be less than 2 minutes or more than 5 minutes after all the ingredients have been placed in the mixer.

Any concrete surplus to immediate requirements shall be thrown away. In no circumstances may the surplus be used later.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed.

Records of each batch showing weights of the various components of the mix, results of testing carried out to determine the insitu water content of the aggregate prior to mixing, the quantity of cement added and its location and time of placement in the structure shall be kept on site.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements of the local code and Consultant requirements.

The placing temperature of concrete shall not be more than 32^0 C. If it is more, the Consultant may order addition of ice or chilled water to the concrete.

1.5.4. Transport and Delivery

Transit trucks shall comply with the relevant code, with an agitating speed between 2 and 3 RPM and mixing speeds in the range of 10 - 20 RPM. The elapsed time between charging of the mixer and discharge at the site shall not exceed 45 minutes, and the concrete temperature at time of placement shall not exceed 32^oC.

Before unloading of any truck at the site, the Contractor shall supply a certificate from the supplier for the load.

The maximum water cement ratio, as specified and determined in the approved mix design shall not be exceeded.

The Contractor shall keep records showing for each batch of concrete produced, the weight of cement, weight of each grade of aggregate used, amount of approved admixtures added, weight of added water and the results of tests made to determine the water contained in the aggregate. The records shall be cross referenced by the Contractor at the site to show locations in the pour where the batches were placed.

1.5.5. Shrinkage cracks

Concreting shall be avoided in very hot weather. If necessary exposed concrete surfaces shall be covered with damped hessian within 2 hours of placing of concrete.

To achieve good results the concrete shall be immediately covered with a plastic sheet and not allowed any direct wind contact. This shall eliminate shrinkage cracks.

1.6. Placement of Concrete

1.6.1. Approvals

No concrete shall be placed without the Engineer's approval. In particular, the Contractor shall submit for approval by the Consultant a schedule showing proposed construction joint locations and the sequence in which the Contractor intends to place the concrete, at least six weeks before any concrete is required on site.

The Contractor shall seek the Consultant's approval at least 24 hours prior to the formwork and reinforcement being ready for inspection, and the intended time for the pour to commence. Adequate time, but in any case not less than eight hours, shall be allowed by the Contractor for the Consultant inspection work.

Concrete placement shall not commence until inspections have been carried out, outstanding work completed or corrected and approval to proceed given by the Engineer.

All built in conduits, pipes, fittings, guards, blockouts, bolts, reinforcement and other fittings shall be in a position and secured before placing is commenced.

Formwork should be clean, free from sawdust, pieces of wood or any other foreign material. It should have been treated by for releasing agent prior to the laying of reinforcement and concrete.

1.6.2. Method of Placement

Concrete shall be placed in position within 45 minutes from the time it is produced. Concrete shall be laid during normal working hours. Concreting at night or on holidays shall be permitted only on the written approval of the Consultant.

Concrete shall be as gently deposited as is practically possible, in its final position to avoid rehandling and shall be so deposited that segregation of aggregates does not occur. In case of deep trenches and footings, it may be done with the help of a chute. Concrete shall not be dumped away from the face of concrete already in place. It shall be dumped into the face of concrete already in place.

Concrete onto a sloping surface shall be discharged by providing a chute with a baffle and a drop at its end so that the concrete remains on the slope.

Columns and walls shall be concreted in one operation to their full height to avoid any horizontal construction joint.

Concrete shall be placed in layers not exceeding 450mm deep in deep beams and placed to the full depth in slabs and small beams. When a layer is not completely placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding layer has taken its initial set and in a manner that will entirely breakup and prevent any construction joint forming between the layers. All placements shall be made in one continuous operation between construction joints or approved by the Consultant. Construction joints shall be in accordance with Clause 3.7.5.

1.6.3. Compaction of concrete

Concrete shall be thoroughly compacted as depositing proceeds by means of suitable vibrators. The vibrators shall maintain the entire concrete under treatment in an adequate state of agitation and shall continue during the whole duration of concrete placement. Care shall be taken not to over- vibrate the concrete. While withdrawing vibrator needles, no holes should be visible in concreting. Compaction shall be completed before the initial setting time. Concrete already set shall not be disturbed by successive vibrations.

It shall be ensured that the needle vibrators are not applied on reinforcement which may destroy the bond between concrete and reinforcement.

When electric vibrators are in use, the standby petrol vibrator must always be available at the concreting point. At least two (2) vibrators shall be used, and an adequate number of standby vibrators shall be available on site in case of breakdowns. Vibrators shall be operated by workmen skilled in their use. Should the vibration of the concrete not be to the satisfaction of the Consultant, at the Consultants request, the Contractor shall replace the person currently in control of the vibrator.

1.6.4. Hot Weather Requirements

In hot weather, precautions shall be taken to avoid premature stiffening of fresh mix and to reduce water absorption and evaporation losses. Where the temperature of the surrounding air is higher than 32°C, the following provisions shall apply:

(a) The concrete shall have a temperature not higher than 32°C when placed, either following the use of chilled mixing water, or by water spraying of the coarse aggregate or both, and if necessary by covering the container in which the concrete is transported to the forms.

(b) The formwork shall be continuously sprayed with cold water in advance of the concreting. Excess water shall be removed from the inside of the forms immediately prior to the concrete placement. The reinforcement and the formwork, if metal forms are used, shall be protected from the effects of hot winds and direct sunlight.

(c) The concrete shall be mixed, transported, placed and compacted as rapidly as possible, and the element of structure shall then be covered with an impervious membrane or with wet sand or wet hessian, kept wet until moist curing ends.

(d) Curing compounds shall not be used as an alternative to the requirements of paragraphs (b) or (c) above. Curing compounds are to be approved by the Consultant prior to use.

1.6.5. Construction joints

In large pours, it is practically not possible to carry on concreting continuously and hence construction joints shall be provided. Location of construction joints shall be submitted by the Contractor for approval of the Consultant. Such joints shall be kept to a minimum. The joints shall be at places where shear force is nil or minimum and these shall be straight and at right angles to the direction of the main reinforcement.

Stop ends provided shall be with necessary slots for reinforcement bars to pass freely without bending or any other obstruction. Also a trapezoidal fillet nailed on stop board shall be provided to form a regular keyed joint. Joints shall be straight and truly vertical or horizontal.

Before commencement of concreting, adjacent concrete stopper and surfaces shall be chipped and roughened to expose aggregate. When wire brushed and cleaned the concrete surface shall be sprayed with water for 24 hours before casting and kept wet until casting.

True horizontal joints shall also be provided with a keyed joint by inserting planed greased timber.

It shall be treated as above prior to the start of fresh concreting.

For vertical joints neat cement slurry shall be applied on the surface just before concreting. For horizontal joints, the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in the concrete mix. This layer of cement slurry shall be freshly mixed and applied just before concreting.

The location of all joints is to be approved by the Consultant.

1.6.6. Expansion Joints

Expansion joint shall be formed and located as detailed in the drawing.

1.6.7. Curing

Curing of concrete is an extremely important aspect of the work. There shall be no compromise on this activity and it is for the Contractor to arrange for everything necessary to make sure that the concrete is cured to the complete satisfaction of the Consultant. As noted in Clause 3.6.5, after concrete has begun to harden (i.e. about 1 to 2 hours after laying), it shall be protected from quick drying with moist or damped hessian cloth or any other material approved by the Consultant. After 12 hours of lying of the concrete, the surface shall be cured by flooding with water for a period of 10 days to keep it moist.

1.6.8. Finishing

Concrete shall be finished keeping in mind the next operation to be carried out over the surface. For guidance the following points shall be noted but the Engineer shall be consulted prior to start of concreting and his decision in this regard shall be final.

i)Roof slab shall be travelled even and smooth with a wooden float.

ii)Surfaces that will receive plaster shall be roughened immediately.

iii)Surfaces that will be in contact with any masonry work shall be roughened immediately.

iv)The surfaces that will receive mosaic floor or IPS or any other type of tiled work shall be roughened while it is green. Every care shall be taken not to disturb the freshly laid concrete.

v)Workshop floor shall be broom finished transverse to the direction of the slope.

Particular attention should be given to the surface tolerance for all floors. This being □6mm. Failure to achieve this tolerance will require the Contractor to apply at his expense a self-levelling epoxy or mortar.

1.6.9. Inspection and corrective measures

On removal of formwork, the surface shall be examined by the Consultant. Till such time, no remedial measures shall be carried out by the Contractor. All patching, rectification or chipping shall be done only on the Consultant instructions. In case of any violation of this rule, the concrete poured shall stand rejected. The decision of the Consultant in this regard shall be final and binding on all parties.

Sagged, bulged, patched, honeycombed work shall stand to be rejected for surfaces that are exposed, or require fair face finish or decorative textured finish. The Consultant may permit any work found structurally safe and areas of unexposed faces, for repairing. As directed by the Consultant these works shall be retained and the cost of repair shall be to the Contractor's account.

Cracks observed shall be brought to the notice of the Consultant who shall examine them. It shall be kept under observation and a record shall be maintained for a period of 45 days. It shall be shown to the Engineer and the following procedure shall be followed :-

a) Cracks not developing further and in the opinion of Consultant, detrimental to the strength of the construction shall be grouted with non-shrinking cement slurry, epoxy or as directed by the Consultant.

b) Cracks developing further and, in the opinion of the structural Engineer, detrimental to the strength of construction, shall be tested as per the relevant Indian standard

c) Based on results of the test, the Engineer in consultation with the Design Consultant shall order remedial measures or order the Contractor to dismantle construction, cart away the debris, replace the construction and carry out all the consequential works thereto.

d) The decision of the Consultant in this matter shall be final and binding on all parties. This decision shall not be open for arbitration.

1.7. Testing/Acceptance

1.7.1. Quantum of cubes and testing

The minimum frequency of cube casting shall be as follows. Each sample shall consist of 6 cubes.

Concrete Quantity	Number of Samples
Up to 5 cu m in a day	1
5 cu m to 15 cu m	2
15 cu m to 30 cu m	3
30 cu m to 50 cu m	4
More than 50 cu m	4 + one additional per each 50 cu m or part thereof

In addition, samples shall be taken whenever any of the materials or the proportions of the mix are changed or whenever directed by the Engineer.

The samples shall be taken, and the test cubes cured in accordance with the requirements of IS:1199 - 1959 and IS:516 - 1959. Three shall be tested after 7 days and the remaining three after 28 days in a laboratory approved by the Consultant.

The cube tests shall be in accordance with IS 516 - 1959.

The number of cubes in each sample may be reduced by the Consultant if consistently satisfactory results are obtained, or increased up to a maximum of 12 when, in the opinion of the Consultant, additional tests are required as, for example, in the early stage of the works.

The Contractor shall supply or arrange all labour and equipment for the sampling and testing of concrete as specified. The costs of this sampling and testing shall be borne by the Contractor and shall be deemed to be included in the tendered rates and prices for concrete works.

1.7.2. Acceptance of work

It shall be as given in IS 456 - 1978, SP 23 and SP 24. The Guidance brief is as under.

Part or element of work shall be deemed to be accepted, provided the results of the 28th day cube testing conform to the criteria stated as under.

a) The average of the three consecutive cubes strength shall not be less than the specified strength.

b) No individual cube strength shall be less than 90% of the specified strength.

c) If the individual cube strength exhibits more than 133 % of the specified strength, such a cube shall be classified as freak and the criteria in (a) and (b) shall be applied to the remaining two cubes and their acceptability determined.

d) If the concrete tests fail to meet the acceptance criteria of the minimum strength required for respective grades of concrete, the Engineer may take one of the following decisions:

i. Instruct the Contractor to carry out such additional tests (e.g. core tests, load tests, etc.) and/or remedial measures to ensure the soundness of the structure at the Contractor's expense.

ii. Any decision to accept the work shall be entirely at the discretion of the Consultant who may make a reduction in the rate of the appropriate item.

iii. The Work will be rejected and any consequential action as needed shall be taken at the Contractor's expense including cutting out and replacing a part or whole of the work.

In addition to the above plastic concrete is liable for rejection if the time since completion of mixing is greater than 45 minutes or the appearance and cohesiveness of the particular quantity is significantly different from previously supplied quantities of the same specification.

Hardened concrete shall be liable to rejection if -

(a) It does not satisfy the strength requirements of this specification,

(b) It is porous, segregated, honey-combed, or contains surface defects; or

(c) It fails to comply with other requirements of this specification.

All remedial work to bring rejected concrete to an acceptable standard shall be to the Contractor's cost and to the approval of the Consultant.

1.8. Repair Work

Concrete which is unsatisfactory shall be repaired by cutting out the unsatisfactory material and by replacing it with an approved repair material. Voids to be so filled shall be provided with anchors, keys or dovetail slots whenever necessary to attach the new material securely in place. Surface of prepared voids shall be wetted for 24 hours immediately before the patching material is placed. Repair of concrete shall be made by skilled workmen. Repairs shall be made as soon as practicable after removal of forms and in a manner to meet the requirements for the finish specified for the particular location.

Repairing leakages in liquid retaining structures which become apparent during leak-testing will also have to be repaired by the Contractor at his own cost following methods and specifications as directed by the Engineer.

For repair of the concrete works, the Contractor may use epoxy as a bonding agent prior to placing the repair material. The use or otherwise of epoxy for the repair work will be at the discretion of the Consultant. Epoxies shall be applied in strict accordance with the instruction of the manufacturer.

Approved brands of repair material and chemicals shall be used to repair surfaces of damaged concrete at the discretion of the Consultant. The repair work shall be carried out strictly in accordance with the manufacturer's recommendations as regards the preparation of surface, cleaning, hacking, applying bonding agents, admixtures, polymer mortars etc. Any deviation shall be certified by the Consultant before being brought into execution.

Filling material or grout used in repair of surfaces which will be exposed after completion of the project shall be made with cement from the same sources as that used in concrete and blended with a sufficient amount of white portland cement to produce the same colour as in the adjoining concrete. Patched surfaces shall be given a final treatment as required to make the texture of the patch match that of the surrounding material.

Immediately after patching is completed, the patched area shall be covered with an approved non-staining, water-saturated material which shall be kept wet and protected against sun and wind for a period of 12 hours. Thereafter, the patched area shall be kept continuously wet by a fine spray or sprinkling for not less than 10-days.

All materials, procedures and operations used in the repair of concrete and also the finished work shall be subject to the approval of the Consultant. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks, or drummy areas after the fillings have been cured and dried.

The extent of repair shall be decided upon by the Consultant. The cost of repairs of defective areas shall be borne by the Contractor. The Engineer may adopt at his discretion any other method of repairing like grouting with cement grout, epoxy grouts or guniting etc. This shall be carried out by the Contractor at his cost as per the specifications supplied by the Consultant.

Repairing shall be carried out only if the Consultant feels that it is sufficient only to repair the concrete and demolition and reconstruction is not necessary.

1.9. Reinforcement

Reinforcement bars used in construction shall be mild steel or medium tensile steel round bars and high strength deformed bars. Refer to the drawings for details.

1.9.1. M S Plain

Rolled mild steel and medium tensile steel plain round bars used in concrete shall conform to IS 432 - 1982 Part I. Steel received shall conform to the following IS with regard to manufacturing and chemical composition.

1. M.S. bar Grade I Steel designation Fe 410-S of IS 2062 - 1992.
2. M.S. bar Grade II Steel designation Fe 210-O of IS 1977 - 1975.
3. Medium Tensile Steel designation Fe 540 W-HT Steel bars IS 8500 -1991

Nominal sizes and tolerances shall be as specified in IS 432 - 1982Part I. Physical requirements shall be determined in accordance with IS 1608, read in conjunction with IS 2062 - 1992.

1.9.2. Tor Steel

High Strength deformed bars for use as reinforcement in concrete shall be of grade Fe 415, Fe 500 and Fe 550 conforming to IS 1786 - 1985

Chemical composition shall conform to IS 1786 - 1985 when made as a relevant part of IS 228 -1959.

Nominal sizes, cross sectional areas and their mass shall be as specified in IS 1786 - 1985, allowing due consideration for tolerances specified therein.

Physical properties

1) It shall satisfy IS 1599 - 1985 test for bend and rebend test in conjunction with IS 226.

2) Bond requirements shall be deemed to have been satisfied if it meets clause 4.0 of IS 1786 - 1985.

3) Tensile, proof stress and percent elongation shall be as per Table 3 of IS 1786 - 1985.

1.9.3. Delivered Material

a) Material received at site shall have ISI certification mark. Each bundle or coil containing the bars shall be suitably marked with ISI certification mark. Bars shall also be marked to identify categories. This shall be done as per IS 1387 - 1993.

In case bars are without ISI certification mark, the manufacturer shall give a certificate stating process of manufacture, chemical composition and mechanical properties. Each certificate shall indicate the number or identification mark of the batch production/cast to which it applies. Corresponding number or identification mark should be found on the material.

b) All reinforcement material shall be free from loose mill scale, excessive rust, loose rust, pitting, oil grease, paint, mud or any foreign deleterious material present on the surface. Cleaning shall be done to the satisfaction of the Engineer.

c) Each batch brought at site shall be tested prior to use for respective specification/ physical properties. Cost of all such tests shall be borne by the Contractor. Material acceptable as per IS shall be allowed into the works. All rejected material shall be removed from site by the Contractor within 3 days of rejection. This will be without any appeal and shall not be subjected to arbitration.

d) Reinforcement bars received at site shall be stored on hard concrete platform and clear of the ground with the use of timber sleeper, concrete sleeper or suitable other means. Reinforcement material shall be kept covered by tarpaulins or plastic to avoid excessive corrosion and other contamination. It is advised to follow storage methods as described in IS 4082 - 1977.

1.9.4. Fabrication of reinforcement

Reinforcement shall be fabricated in accordance with the Drawing or as directed by the Consultant. Bending shall be done mechanically or by hand, to the correct radius, with proper tools and platform and shall conform to IS 2502 - 1963. Bars shall be cold bent only. Material shall be inspected for visible defects such as cracks, brittle, excessive rust, loose mill scale, etc. Cracked ends of bars shall not be used in Works. Bars should be free from any deleterious material and hence the best practice shall be to hose down reinforcement just prior to concreting.

It is important that bending, straightening, cutting, etc. shall be carried out in a manner not injurious to the material and the safety of the persons working should be ensured.

1.9.4.1. Anchoring of Reinforcement

Anchoring of bars and stirrup shall be provided in accordance with the details on the structural drawings or as directed by the Engineer.

1.9.4.2. Lapping of bar -Lapping shall be strictly as per the drawing or as directed by the Engineer. For general guidance, the following principle shall be followed as given in IS 456 - 1978.

1.9.4.2.1. Splices shall be provided as far as possible away from sections of maximum stress and be staggered.

1.9.4.2.2. Not more than half of the total bars shall be spliced at a section.

1.9.4.2.3. Where more than one half of the bars are spliced at a section or where splices are made at points of maximum stress, special precautions shall be taken, such as increasing the length of lap and/or using spirals or closely spaced stirrups around the length of the splice.

1.9.4.2.4. Lap length including anchorage value of hooks in flexural tension shall be Ld (as defined in 23.2.1 of IS 456 - 1978) or 30 dia whichever is greater. The straight length of lap shall not be less than 15 dia. or 200 mm., Where Ld is the development as described in 23.2.1 of IS 456 - 1978.

1.9.4.2.5. When splicing of welded wire fabric is to be carried out, lap splices of wires shall be made so that the overlap measured between the extreme cross wires shall be not less than the spacing of cross wires plus 100 mm.

1.9.4.2.6. The lap length in compression shall be equal to the development length in compression, calculated as described in 23.2.1 of IS 456 - 1978 or as specified in drawing but not less than 24 dia.

1.9.4.3. Spacing of bars

Bars shall be placed in position as shown in the drawing. Guidelines as given in IS 456 - 1978 shall be followed or in case of difficulties as directed by the Consultant.

i) Horizontal distance between two parallel main reinforcing bars shall usually not be less than the greatest of the following:
   a. The diameter of the bar, if the diameters are equal;
   b. The diameter of larger bar, if the diameters are unequal; and
   c. 5 mm more than the nominal maximum size of coarse aggregate (By using reduced size of aggregate in congested reinforced area, conditions given here of should be overcome.)

ii) When needle vibrators are used, the distance between bars of a group may be reduced to two-thirds of the nominal maximum size of the coarse aggregate, provided sufficient space is left between groups of bars to enable the vibrator to be immersed.

iii) Where there are two or more rows of bars, the bars shall be vertically in line and the minimum vertical distance between the bars shall be 15 mm, two-thirds the nominal maximum size of the aggregate or the maximum size of bar, whichever is more.

1.9.5. Cover to reinforcement

Reinforcement shall have concrete cover and the thickness of such cover (exclusive of plaster or other decorative finish) shall be as noted on the Drawings or, if not noted, as listed below:

i) At each end of the reinforcing bar, not less than 25 mm.

ii) For a longitudinal bar in a column, not less than 50 mm.

iii) For longitudinal reinforcing bar in beam, not less than 40 mm.

iv) For tensile, compressive, shear or other reinforcement in slab, not less than 25mm.

v) For tensile, compressive, shear or other reinforcement in chajja, not less than 40mm.

Concrete cover should not exceed 75 mm in any case.

1.9.6. Fixing in position

Correctly cut and bent bars shall be accurately placed in position as detailed in the drawing. Unless otherwise specified by the Engineer, reinforcement shall be positioned within the tolerance as under

i) For effective depth 200 mm or less, ± 5 mm

ii) For effective depth more than 200 mm, ± 10 mm

In no case shall the cover be reduced by more than 5 mm of that specified. There shall be no compromise on cover for foundation work.

Reinforcing bars shall be held in position during the placing of concrete by use of concrete cover blocks (made of equal strength of well-cured concrete in use) or Steel chair spacers and secured by tying with an annealed binding wire of 16 to 18 gauge as approved by the Consultant.

Layer of bars shall be separated by precast concrete spacer blocks or spacer bars. Reinforcement shall be in correct position prior to start of concreting. No reinforcing bar shall be placed on freshly laid concrete for adjusting bar spacing. Care shall be taken to maintain reinforcement in position and keep it clean, throughout the period till it is embedded in the concrete. For maintaining cover, pieces of broken stone of brick or wooden blocks shall not be used at any stage.

Galvanised binding wire used shall conform to IS 280 - 1978.

Welded joints or mechanical connections may not be used. Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care should be taken to ensure that at no time is the radius of the bend less than 4 bar diameters in case of plain mild steel or 6 bar diameters for deformed bars. Care shall be taken when bending back bars to ensure that the concrete around is not damaged/ disturbed.

1.10. Formwork

The materials, design, and construction of formwork (including bracing and shoring) shall comply with the Indian Standard Code of Practice for falsework and below.

Specifically, forms for concrete work shall be so constructed and erected as to resist the force exerted on them with the deflection at any point no greater than three (3) mm. Forms shall be sufficiently tight to prevent the leakage of mortar/grout.

The responsibility for the sufficiency of the whole of the formwork shall rest entirely with the Contractor who shall engage a qualified Engineer experienced in formwork construction methods to structurally design the formwork.

Forms for exposed surfaces shall be made of dressed timber or metal. Angle fillets shall be used in the angles of side forms. The junction of soffit and side forms shall be cast with a 25x25 fillet, and the top edge of the slabs and all corners shall be cast with a 25mm x 25mm chamfer.

Forms shall be true to line and conform to the dimensions and levels shown on the Drawings.

The interior surface of forms shall be oiled or greased with an approved non-staining mineral oil prior to the placing of reinforcement, and any surplus moisture shall be removed from the forms prior to concreting.

All deleterious material such as dirt, clay, wire, reinforcing bar, wood chips, etc. shall be removed from the forms prior to concreting.

Should any formwork be displaced during concrete or within the periods specified for the retention of formwork, the concrete shall be removed between such limits as the Consultant may determine, construction joints shall be formed and the section of work shall be reconstructed after the formwork has been strengthened and adjusted.

Formwork shall remain in place for the minimum time as specified in IS:456 - 1978 or as varied within this specification and shall be removed with care in accordance with this code. Not withstanding this, side forms may be stripped after the minimum time specified in IS:456 - 1978 has elapsed (but in any case not less than 24 hours) after the concrete has been poured, provided that the surfaces exposed are immediately sprayed with an approved curing compound and curing is carried out in accordance with this specification. Bottom forms shall remain in place for 14 days after pouring or as otherwise approved by the Consultant.

When forms are reused, their original shape, strength, rigidity, mortar tightness and surface smoothness shall be maintained. All material previously used in formwork must be cleaned off and oiled before reuse.

Formwork shall be constructed so as to ensure uniform quality and texture over large areas, built to close tolerances and exhibit consistently good quality edge and joint details.

Deflection readings

Of various elements shall be taken as directed below :-

Type of member	Compression steel as percentage of tension steel.	Camber coefficient K
Simple span	0	0.066
	50%	0.037
Continuous OR Restrained span	0	0.032
	50%	0.020

Type of member	Compression steel as percentage of tension steel.	Camber coefficient K
Cantilever span	0	0.086
	50%	0.046

Camber (in cm.) = 2.54 K * L / D

Where K = Camber coefficient

L = Length of member in meter

D = Depth of member in meter.

The formwork shall be designed and constructed to the shapes, lines and dimensions shown on the drawings within the tolerances to conform to relevant clauses of IS-456.

1	Deviation from specified dimensions of cross section of columns and beams.	- 6 mm
2	Deviation from dimensions of footings	+ 12 mm
	1. Dimensions in plan	- 12 mm
	2. Eccentricity 0.02 times the width of the footing in the direction of deviation but not more than 50 mm	+ 50 mm
	3. Thickness > 0.05 times the specified thickness.	

The stripping time for the shuttering and formwork shall in general conform to the provisions in the relevant clauses of IS : 456. In normal circumstances, generally where temperatures are above 20 Degree C, and where ordinary Portland cement is used, forms may be struck after expiry of following periods :

	Concrete items		Minimum OPC (IS-269)	Stripping Time (IS-1489)
1	Footing, walls etc. having a uniform & direct bearing on ground.		24 hr	3 hr
2	Columns, walls, vertical sides of beams etc.		24 hr – 48 hr	
3	Slab (props left under)		3 days	7 days
4	Beam soffit (props left under)		7 days	15 days
5	Removal or props slabs			
	1	Span up to 4.5 m	7 days	15 days
	2	Span over 4.5 m	14 days	21 days
6	Removal of props Beams			
	1	Span up to 6 m	14 days	21 days
	2	Span over 6 m	21 days	28 days
7	Cantilever construction		Not until adequate fixity is developed subject to min. 28 days.	

NOTE : This stripping time is subject to attainment of cube strength of 85% and 100% of grade strength at 21 & 28 days respectively. For rapid hardening cement stripping time can be reduced to 3/7th of that for OPC but not less than 24 hrs. Before removal of the formwork, the concrete shall be examined and the permission for removal of form work shall be obtained from the Engineer whose decision shall be final and binding. In case of doubt or in special cases where it may be required to leave the formwork for a longer period, no claim

monetary otherwise shall be entertained from the contractor on this account. Formwork shall be removed without causing shock or vibration.

1.11. Construction Loads

The Contractor should be aware that no additional reinforcement has been allowed for construction loads arising out of the construction method. The Contractor shall consider this in his construction process and advise the Consultant of his proposed details for ensuring the structure remains in a structurally sound condition during the construction process. This maybe able to be achieved by the use of forms or additional reinforcement.

1.12. Precast RCC Grills

Precast RCC Grills will be provided as per design specified in the drawings with the necessary dimensions. The grills will be 75mm thick and will be vibrated on table mounted vibrators with a mix of 1:5:10 (one cement: 5 parts sand: (5 parts grit + 5 parts metal No. 1) finished in a cement slurry (1 cement: 1 water) wash.

The grills will be fixed/ erected and all joints between the grills and opening will be fitted with cement slurry wash or 1:4 (cement:sand) mortar depending on the gaps width so as to not have any gaps in the opening provided for the RCC grills.

2. PLASTERING AND POINTING

INDIAN STANDARDS

All relevant Standards as specified elsewhere in this volume are applicable.

Indian standards to be followed are:

1	IS 383	Specification for coarse and fine aggregates for natural sources for concrete.
2	IS 412	Specifications for expanded metal steel sheets for general purposes.
3	IS 1542	Specifications for expanded metal steel sheets for general purposes.
4	IS 1635	Code of practice for field slaking of building lime and preparation of putty
5	IS 1661	Code of practice for application of cement and cement-lime plaster finishes.
6	IS 2394	Code of practice for application of lime plaster finish.
7	IS 2402	Code of practice for external rendered finishes.
8	IS 2645	Specifications for integral cement water proofing compound.

MATERIALS

Cement, lime, surkhi, water shall conform to the respective specifications of section II: (Concrete and Mortar) of this volume.

Coloured cement may be either ready-mixed material or may be obtained by mixing pigments and cement at site. The pigments to be mixed with cement shall conform to Appendix "A" of IS 2114 code of practice for laying in-situ Terrazzo Floor Finish.

Sand shall conform to IS 1542 specification for sand and plaster. For white or coloured renderings, only quartz or silica sand shall be used. For textured finishes produced by treatment of freshly applied final or finishing coat with a tool coarser, particles used shall be screened through 3.35 mm IS sieve. For torn texture a slightly larger portion of material coarser than 4.75 mm IS sieve shall be used.

Aggregate shall conform to IS 383.

Marble dust obtained from crushing of hard marble stone shall not contain more than 8% of slit determined by field. Test. Fineness modulus shall be greater than 1.0

Integral water proofing compound shall conform to IS 2645 (specification for integral water proofing compound).

Neeru shall be obtained by mixing lime putty and sand in equal proportions and chopped lute @ 4 kg/cu m of mortar and ground to fine paste in the chemical grinder to give fine butter-like paste.

WORKMANSHIP

Preparation of mortar mix

The material used in preparation of plastering mixes shall be measured by volume using gauge-boxes or by weight.

When cement is measured by weight, 1440 kg of material shall be taken equivalent to one cubic meter.

Mix proportion of lime, unless otherwise stated, generally refers to the volume of lime putty

Mixing

Mixing shall be done mechanically or manually if approved by the EIC Machine mixing shall be preferable to hand mixing for cement mortar. Each mortar batch shall be used within half an hour. Hand mixing operation shall be continued with addition of necessary quantity of water until a uniform appearance and consistency of mortar s obtained.

Cement-lime or cement-sand-mortar shall be prepared as follows

A Lime putty and sand shall be mixed first and kept from drying out. Cement shall be added as and where required and mixed with water if necessary to the minimum extent to give a working consistency for the plaster.

B If fine sand is used, cement and sand shall be dry mixed first. Lime putt, thinned with water, Shall be added to the mixes and mixed until a satisfactory mortar obtained.

C Cement and sand shall be mixed dry in required proportion to obtain a uniform colour, and water shall then be added to get the required consistency for the plaster.

Surfaces to be plastered must be clean and free from dust, loose material, oil, grease, mortar droppings, sticking of foreign matter, traces of algae, etc. It is very important to ensure that there should not be any chance of the plaster getting de-bonded due to presence of materials harmful for bonding.

Raking out of joints is expected to be carried out along with masonry but it should be checked thoroughly so as to receive good key.

Walls should be sufficiently damp prior to plastering. Water from plastering mortar must not be absorbed by masonry under any condition.

Any unavoidable projections in masonry and concrete surfaces shall be chiselled back. Care shall be taken that surrounding surfaces are not damaged and reinforcement is not exposed.

Thickness of one coat should not be more than 12 mm and less than 8 mm for single finished plaster.

In case of multi coat plaster, sufficient time shall be allowed for the undercoat to harden (cured dried and shrunk properly) before subsequent coats are applied.

Undercoats shall be scratched or roughened before they are fully hardened to form a mechanical key.

The method of application is also important and hence it is recommended to form a mechanical key.

The method of application is also important and hence it is recommended that the mix be thrown on the surface rather than stuck with trowel. This increases the adhesion.

Scaffolding should be rigid, allowing free and safe movement on the platform and it should be at sufficient distance or height from the working areas. Scaffolding with railing gives more confidence to workers and increases the quality of work.

Actual plastering shall be undertaken only on the approval of the EIC. Plaster work should only follow the steps mentioned below:

a) Surfaces must be thoroughly cleaned.

b) Plaster area must be provided with level dabs or spots allowing working and checking with 2-3 m straight edge. Depth of plaster must not be less than 8 mm at any point.

c) Required concealing services must be completed and tested.

d) No further cutting of masonry must be required.

e) Repairs carried out to masonry or concealing work must be cured and dry.

f) Surface must be sufficiently damp.

g) Plaster dabs are checked for plumb and level by the EIC or his representative.

h) Joints concealing and repairing areas must be covered with chicken mesh as per the EIC's instruction.

Corners, external or internal, shall be finished along with final coat. It is advisable to have rounded corners.

Plaster shall be cured for 14 days by wet curing except in neeru finish plaster. During this period plaster shall be protected from exposure to extremes of temperature and weather.

Plaster shall be levelled and lined by aluminium hollow section,2-3 m long. (This will give even and levelled surface). There shall not be more than 2 mm difference in level when checked with 3 m straight edge. It is important that enough pressing and beating is done to achieve compact filling of joints and that the area is fully compacted.

Finishing of plaster may be carried out with wooden float (randhas) or trowelled smooth with sheet metal trowels as specified. Care shall be taken to avoid excessive trowelling and overworking of the wooden float.

All corners, internal or external, shall be truly vertical or horizontal. These shall be finished with a proper template to achieve best workmanship for rounding and chamfering as specified or directed.

Plaster shall be cut to correct horizontal or vertical line at the end of the day or if work requires to be suspended for any reason.

It is advisable to limit the area of plaster to 15 sq m to avoid cracks due to thermal movements of dissimilar material in contact. It is advisable to provide joints treated with groove or any other detail as suggested by the Architect. These joints if not specified shall be treated with 150 mm wide reinforcing chicken mesh (approved by the EIC) fixed over joints by G.I. nails and the area plastered.

2.1 TYPE OF PLASTER

12 mm thick ordinary cement sand plaster

Single coat cement sand plaster with cement-sand mix proportion of 1:4 shall be carried out over the entire area as detailed above This shall be finished just with wooden float to give the best smooth surface possible. This may be for internal or external areas Thickness may be from 10 to 15 mm maximum or as specified in the item or drawing.

18 to 25 mm ordinary cement sand plaster.

This is the same as for the 12 mm thick single coat plaster except that this shall be carried out in two coats. Maximum thickness of the undercoat shall be 12 mm and balance in the second finishing coat. All operations remain the same and are as detailed in point 3.0.

Neeru finish plaster

12 to 18 mm thick internal plaster shall be carried out as above in single or two coats respectively. 2 to 3 mm thick neeru shall be applied over the plaster when it has just hardened. It shall be finished smooth by a steel trowel and worked over to achieve smoother finish. Curing shall start only after 24 hours after neeru punning has been completed. This shall not be hosed down like other plaster but kept wet by a slight sprinkling of water for a period of 10 days.

Cement finished plaster

This shall be carried out in the same manner as in 4.1 and 4.2 for specified thickness in single or double coat. Then it shall be finished uniformly over the entire area with a paste of neat cement when the plaster has just hardened and finished smooth with a steel trowel. It shall be worked over again to achieve a smooth levelled surface. Quantity of cement applied shall be about 1 kg/sq m.

Sand face plaster

This shall generally be carried out on the outside face and exposed area of masonry work and concrete work. It shall be of minimum 20 mm thickness and shall be two coats. The coat shall be 1:4 (1 cement and 4 sand) mixed with waterproofing compound 2% by weight of cement applied as usual and surface shall be keyed.

The second coat shall be applied after 7 to 10 days and shall be of CM 1:4 (1 cement and 4 sand). Mortar shall be mixed with slightly coarse sand. Mix shall be worked over with 3 m gauge or wooden float to achieve an uniform surface.

The surface shall be allowed to harden sufficiently for sponging operation. Sponging shall be done by dipping sponge in cement water and removing fine particles and exposing large sand particles. The movement of sponge shall be such that no patches develop nor is excessive material removed from the surface. There shall not be a difference of more than 7 mm when checked with 2 m long straight edge.

ROUGH CAST PLASTER:

a) Rough cast plaster in two coats shall be provided to external faces of walls including jambs of doors and windows, opening and external surfaces of parapets all as specified in the drawings or Bills of Quantities.
b) Under coat 12 MM to 15 MM thick in Cement Mortar 1:3 keeping the surface rough to receive the second coat of plaster.
c) Finishing coat mortar shall be in proportion of one part of cement and 1.5 part of specially selected fine sand and three part of gravel of 5 to 8 mm size. It shall be flung upon the first coat with large trowel to form an even and decorative coat. The work shall generally conform to clause 16.5 of IS 1661-1961. The thickness of the coat shall be about 10 MM. It shall be cured for 7 days. The surface after curing shall be applied with 3 coats of Snowcem water
d) Proofing paint. Grooves as per drawing or as directed shall be formed using wood beads to be fixed over under coat before applying the finishing coat.

RATE

Description of item in the BOQ, unless otherwise stated, includes, wherever necessary, conveyance and delivery handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of packings and other incidental charges.

Levels and heights shall be as indicated in the BOQ.

Preparation of surface shall be as approved by the EIC.

Trimming off the projections on masonry shall be included in the price.

Scaffolding and working platform shall be included in the price.

Materials as detailed and as required to complete item as specified shall be included in the price.

Curing of plaster or pointing shall be included in the price.

Cleaning of adjacent areas, windows, doors, frames, etc. including masonry surface in exposed masonry work, shall be included in the price.

Forming grooves, for joints, between beams/columns and masonry etc. shall be included in the price. Any special treatment if detailed shall be measured separately and billed in BOQ.

Providing and fixing chicken mesh at junction of R.C.C., brick work, edges, corners, chiselled and repaired brick work prior to plaster over concealed conduct, etc. shall be as directed by the EIC it shall be considered as part of item and no separate charge will be payable.

FLOORING

INDIAN STANDARDS

All relevant Standards as specified in elsewhere in this volume are also applicable.

The Indian Standards to be followed are

- IS 777
- IS 1237
- IS 1443
- IS 2114
- IS 2571
- IS 4457
- IS 5491
- IS 5318
-

MATERIAL –

Cement, sand, aggregate, lime, water shall conform to Concrete and Mortar section of this volume.

Stone

Stone for soiling shall be hard, sound, durable and free from defects like cavities, cracks, sand-holes, flaws, injurious veins, patches of loose or soft materials and weathered portions, etc.

Terrazo aggregates

The aggregate used in topping shall be marble chips only. The type of marble shall be as specified or as approved. It should be hard, sound, dense and homogenous in texture with crystalline and coarse grains.

Marble powder used along with chips must pass through IS sieve Terrazzo 30

Pigments

Pigments used in the mix shall conform to Appendix 'A' of IS 2114.

Dividing strips

Dividing strips used in flooring shall be of brass or aluminium or glass as specified in the BOQ or as approved by the EIC. Strips shall be at least 45 mm wide and 3 mm thick or as specified in the BOQ/ drawings

Glazed tiles/ ceramic tiles

Glazed earthenware tiles shall be of specified size and make or equivalent but shall conform to IS 777. Tiles shall be free from cracks, grazes, spots, chipped edges and corners, variation in size shall be limited to +- 1.5 mm. Thickness shall be as specified in BOQ. But in no case shall be less than 6 mm.

Marble/ plain & coloured cement tiles.

The marble used shall be as approved by the EIC and shall be hard, sound, free from cracks, cavities, holes, patches of injurious veins, weathered portions, flaws, etc. fair representation, 4 nos of 300 x 300 mm sized marble pieces shall be submitted for approval Material received shall conform to the said approval group of 4 marbles and no other type shall be accepted. Colour, frain, vein, etc. must conform to the approved sample only. Size and thickness shall be as specified. The marble may be ordered in various sizes to suit the pattern selected by the Architect/EIC. Required pattern matching of marble shall be carried out the contractor while cutting the marble.

Kota stone

Kota stone shall be of approved sizes of achieve the pattern to be approved by the EIC/Architect. Thickness shall be as specified Stone shall be dense, hard and free from cracks, decay weathering and flaws.

Sand stone

Red or white colour sand stone as specified in the BOQ shall be used It may be rough, fine dressed or fine dressed and rubbed, in required thickness and size. It shall be hard sound, durable and rough,free from cracks, decay and weathering. In both colours no patches or streaks shall be allowed. Scattered spots upto 10 mm may be permitted to the discretion of the EIC.

SUB-BASE

Sub-base for all flooring shall be prepared and kept ready for further applications. All items shall be defined and detailed on the drawing.

Measurements shall be as per the BOQ of these items.

Preparation of sub-base may be by doing excavation or back filling in plinth. Back filling shall be with the selected earth in layer of 150 mm to 200 mm maximum and well-compacted to achieve 90% compaction at optimum moisture content.

In case of excavation, the base shall be well-dressed to the desired level and inspected. All loose spots shall be excavated till th hard surface is reached and then filled as directed by the EIC. Surface shall be watered with just sufficient water and rolled and compacted with vibratory compactor/power roller.

Rubble soiling

Good quality 150 mm to 230 mm thick rubble soiling shall be carried out depending upon the grade of soil. Rubble used shall be at least 100 mm for 150 mm thick soiling and 150 mm for 230mm thick soiling. Stone shall be hand packed as close as possible and bedded firmly with the broadest face downwards and he greatest length across, Voids filled with chips and small stones. These shall be hammered down to achieve packing and the complete filling of interstices. To achieve the desired levels and slopes, pegs at suitable intervals (about 12 m) shall be fixed.

Soiling shall be watered and again packed with sand or murum to fill interstics created by watering. Then it shall be rolled with 8 ton roller or vibratory compactor. Filling sand or murum, watering and rolling shall continue till full compactness is achieved to satisfaction of the EIC.

Metal packing

Coarse aggregate used for metal packing shall be crushed or broken stone, hard, durable and free excess of flat, elongated, soft and disintegrated particles, dirt and other objectionable matter.

Prepared sub-base surface as detailed above shall be uniformly spread with well-graded metal. Templates shall be used for levelling. Levelling shall be true and checked with 3 m straight edge Any raised areas or depressions of more than 12.5 mm shall be corrected. This shall be rolled with power wheel roller of 6 to 10 tons as required or as asked by the EIC for the intended purpose. Rolling shall continue till aggregate is thoroughly keyed and the creeping of the aggregate ahead of the roller is no longer visible. The rolled surface shall be checked and all irregularities corrected by loosening the surface, adding or removing necessary amounts of aggregate and re rolling until the complete area conforms to the required datum.

After the coarse aggregate has been thoroughly keyed and set by rolling, screening shall be carried out to fill the interstices. This shall be in 3 to 4 layers. Material shall be dry and no sprinkling of water shall be allowed.

Base Floor:

This shall be regular reinforced concrete floor or cement concrete floor of specified mix. Its thickness shall vary from 50 MM to 150 MM as the case may be. This may be nominally reinforced with reinforcement bar or mesh. It will be provided with Contraction joint of 16 mm dia and 600 mm long mild steel reinforced bars at 450 mm center. Bars shall be debonded in concrete on one side of the bay.

All specification of concreting shall be the same as per Concrete and Reinforcement.

FLOOR FINISHES:

INDIAN PATENT STONE:

Cement concrete floor in a ratio of 1:2:4 (1 cement: 2 sand: 4 aggregate) of 40 to 75 mm thickness shall be laid in panels. Cement concrete shall conform to Concrete and Mortar specifications.

The concrete surface finish may be monolithically laid with structural slab or laid over hardened structural slab. For convenience and to protect final finish in the period of construction, laying of concrete over-hardened structural slab shall be preferred.

IPS laid over hardened structural slab:

a) Hardened structural slab shall be thoroughly wire-brushed, hacked with mechanical scabler to remove all scum, laitance of cement mortar and allowed to expose coarse aggregate. Surface shall be wetted and cleaned thoroughly.

b) Concrete shall be laid in panels. Panels shall be such as to minimise shrinkage and curling. Their length to breadth ratio shall be 1.5:1. It is advisable to keep the maximum length of each panel as 2.0 M

c) Panels shall be formed by providing shuttering of timber or steel angles to deal accurate level. They shall be rigid and watertight. In case dividing strips are to be provided, the same shall be fixed to deal accurate level and concrete poured into them (not required to be in alternate bays).

d) The concrete mix used shall be as stiff as possible. When mix is held in hand it shall for a ball but when released will crumble by itself.

e) All excess water from the surface shall be mopped up keeping surface just wet. Thick cement paste/slurry shall be brushed into the surface just prior to laying of the concrete. It must be noted that slurry shall not be brushed over area where concrete laying is likely to be delayed

f) Concrete laid shall be vibrated and rammed as required it shall be levelled with 3 M staight edge.

g) Surface shall be well trowelled and rubbed smooth to the satisfaction if the Engineer in Charge.

h) No additional dry cement or cement mortar shall be sprinkled on the stiffened concrete surface to achieve smoothness.

i) Concrete shall be kept moist for 14 days.

j) Edges of panels shall be well-compacted to minimise liftings and curlings.

IPS laid monolithic with structural concrete slab:

a) Floor concrete slab shall be allowed to stiffen enough but still be in a plastic stage

b) Mix shall be laid in position and well-compacted with wooden float and levelled with 3 M straight edge.

c) After the surface has become slightly hard steel trowelling shall be carried out to achieve a smooth levelled surface.

d) No additional dry cement or cement mortar shall be sprinkled on the stiffened concrete surface at stage.

e) The concrete shall be wet cured for 14 days.

MEASUREMENT:

Measurement shall be in square metre for specified thickness and for specified mix.

KOTA /SHAHABAD/TANDUR/GRANITE /CADAPPA/STONE FLOORING

Machine cut stone slabs used shall be of 20, 25, 30 or 40 mm thickness. Colour shall be uniform and the slabs free from all defects. Tiles used at site shall be machine- cut (hand-cut permitted if approved or specified in the BOQ).

In machine cut edge tiles, edges shall be protected from any damage in transit. No brakage shall be permitted. All edges shall be sharp, perfectly rectangular and all tiles otherwise shall be rejected outright. Edges shall be pencil-rounded and polished for exposed corners and faces.

In hand-cut slabs, chisel dressing to edges shall be carried out to full depth. Size obtained may be less than specified normal. Dressed sides shall be at perfect right angles to each other and absolutely straight. No edge shall be broken.

Bedding shall be of lime mortar or cement sand mortar as detailed in this section. In all cases of cement-sand-mortar mix a ratio of 1:6 will be maintained unless specified otherwise in the BOQ/drawings.

Laying of kota stone flooring shall be as in above clauses of this section.

Polishing and grinding shall be carried out as in the above clause of this section

Measurement shall be in square metres. Steps and risers for specified width and height shall be measured in running metres for as detailed in BOQ. Rates shall include costs for all labour, material, cutting, dressing, polishing of exposed faces and edges. Wastage etc. including laying in pattern and polishing to the required standard. No extras shall be permitted on any account.

Glazed ceramic tiles

Glazed ceramic tiles shall be laid on structural concrete slab or floor concrete slab. Tiles shall be laid in accordance to IS specifications and Instructions of manufacturer.

Tiles do not require any special bedding as for Terrazzo and stone floor tiles. But to achieve the required slopes, an average 30 to 40 mm thickness bedding of IPS as underlayer and should be provided over this, tiles shall be laid in a cement mortar ratio of 1:4 on a bed of 12 mm thickness.

Sub-grade shall be cleaned, wetted and mopped. IPS shall be laid in required slope/gradients. It Shall be cured for 7 days and the surface shall be kept rough to achieve key with bedding of cement mortar. Cement mortar of about 12 mm shall be spread over the area uniformly and compacted with 3 metre straight edge to achieve dead uniform levels. Surface shall be allowed to harden but in plastic state a thick cement paste by using cement @ 4.4. kg/sq m shall be worked into the bedding. Cement paste shall be applied to the area only where immediate laying of tiles is carried out. Wetted tiles shall be cleaned and fixed in the thick cement pasted bedding. Tiles shall be positioned by tapping with wooden hammer and level checked with straight edge 2-3 meter long. Joints shall be as specified or as thin as possible. Points to be noted prior to start are under.

1) Layout of the tiles is checked and approved by the EIC.
2) End cut tiles are more than half.
3) Floor and wall tiles are in the same line.
4) Change of tiles is below the door shutter.
5) Dividing strip is provided.
6) Cut outs of floor drains are in line with the tiles. Tiles around cutouts are greater than 50 mm or half the tile whichever is greater.
7) Joints shall be cleaned thoroughly and grouted with coloured or white cement as specified. White or colour grout shall be prepared with colour pigments added to cement as per colour of tiles or as directed by the EIC. Grout shall be a thick paste and tooled into joints and area of the tiles cleaned with a damp cloth. Grouting shall be cured by wet curing for 7 days.
8) After 24 hours of grouting tiles shall be cleaned with water and after 7 to 10 days or prior to handing over, tiles shall be washed with mild acid. Care shall be taken that grout does not develop any stain mark.
9) All expansion joints shall be carried out right through and finished by sealing with silicon sealant.

Tiles shall be measured in square meters. Rate shall include for all material, labour, cutting,

fixing grouting, cleaning etc. completed to the satisfaction of the EIC.

SKIRTING/DADO /STEPS/RISERS

Material for skirting, dado, steps, risers shall be as specified above.

Surface preparation shall be same as for flooring for each type backing coat, plaster for dado and skirting shall be done as detailed in the plaster section. It shall be combed for creating a key and better adhesion with skirting material.

In case of steps, bedding shall be laid exactly as flooring and all operations described therein shall be carried out.

External and Internal facings shall be fixed with adequate provision for expansion and compression joints.

The contractor shall supply and fix all necessary supports, anchor slots, anchor cramps and dowels required for the satisfactory completion of all vertical marble or any other stone cladding work. Fixing will be made from suitable nonferrous metal. They shall be in such shape and dimension that they are adequate to carry the loads to be imposed upon thee.

Notwithstanding the above stipulation, the contractor shall be entirely responsible for the sufficiency of fixings.

All anchors and other fixing shall be concealed when the work is completed.

Great care shall be taken to protect delivered and laid marble and other stones from dripping and staining during the course of work.

Skirting or dado tiles shall be fixed as under –

1) Sufficiently hardened backing/undercoat must be damp.

2) Tiles shall be buttered with gray/white or pigmented cement paste on the back side as directed.
3) Tiles shall be fixed on the undercoat and tamped with wooden mallet or rubber mallet
   Achieve full adhesion to the undercoat. Edges shall be tamped to secure line and level.
4) Care shall be taken to achieve pattern of laying with respect to floor or ceiling.
5) Tiles shall be mopped with wet cloth to remove grout coming out from joints. Polishing and cleaning shall be as directed in type of tile above, except that the operation shall be manual.

Measurements shall be in running meters for skirting, steps, risers for specified width. Dado shall be measured in square meters.

Rates shall include material and labour required to complete the item as specified and approved by the EIC. It shall include dividing strips, treating expansion joints, sealing corners and edges around fittings and fixtures etc. all completed approved by the EIC.

WOODEN DOORS AND WINDOWS

INDIAN STANDARDS:

All relevant Standards as specified elsewhere in this Volume are applicable.

Indian Standards to be followed are

- IS 287
- IS 851
- IS 852
- IS 1003 (Part 1 & Part 2)
- IS 1141
- IS 3087
- IS 2191 (Part 1 & Part 2)
- IS 2202 (Part 1 & Part 2)
-

MATERIAL

SUPERIOR QUALITY TEAK WOOD: Means Dandeli, Balarshah and Malabar Teak with Knot upto 1 CM dia and aggregate area of all knots upto ½% of area of piece and it shall not be 6 growth rings per 2.5 CM width.

FIRST CLASS INDIAN TEAK WOOD: Means C.P. & Bulsar Teak, with Knot upto 4 CM dia and aggregate area of all knots upto 1% of area of piece and it shall not be 5 growth rings per 2.5 CM width.

SECOND CLASS INDIAN TEAK WOOD: Means similar to First class teak with Knot upto 2 CM. dia and aggregate area of all knots upto 1.5% of area of piece and it shall not be 4 growth rings per 2.5 CM width

Timber shall have uniform colour, be free from defects such as cracks, dead knots, soft spongy spots and waves of injurious open shakes. Grains shall be reasonably straight. The individual hard and sound knot shall not be larger than 6 Sqcm. The Aggregate area of all knots shall not exceed 0.5% area of piece.

All Timber shall be kiln-seasoned to IS 1141 and conform to IS 287 for moisture content. Maximum permissible limit shall be 3% for average moisture content of all samples from a given lot and 5% for individual sample of the given lot. This is applicable when thickness of timber is more than 50 MM. Timber used shall be treated with 10 year guaranteed and approved anti-termite treatment. Wood work in contact with masonry or concrete shall be painted with hot bitumen coal tar before being placed in position.

READY MADE FLUSH SHUTTERS: Ready made Flush shutter shall be as specified and shall comply to respective code of practice. Shutters shall be of specified thickness. They will have teak wood veneer finish or 1.2 MM thick melamine sheets as specified. These shall be hot pressed and bonded with water resistant formaldehyde synthetic resin of exterior quality as per IS specifications. The adhesive used for bonding corss band to core and face veneer to cross band shall conform to IS 848 .Tolerance on width and heigh shall be

+/- 2 MM and on thickness shall be +/- 1.2 MM. Thickness of shutter shall be uniform throughout. And variation permissible shall be 0.8 MM.

PANELLED SHUTTERS:

The fabricated panelled/ledged and braced timber shutter shall be as per detailed drawing and Fittings and Fixtures shall be as specified in the Bills of Quantities and shall comply to respective IS specifications.

All nails, scres etc. shall be hot deep galvanised or of brass or non ferrous material.

Adhesives and glue shall be as per IS for exterior quality and water repellent.

WORKMANSHIP:

Timber brought at site shall be as approved by the Employer. No timer shall be painted, tarred, oiled, etc.before its inspection by the Employer. Any effort to hide the defects by plugging, painting etc. shall render the piece to be rejected by the Employer.

All rejected timber shall be removed at once from the site of work

All sawing of timber shall be done in straight lines and planes of uniform thickness.

All joints shall be tongued and grooved or of the type shown in the drawings specified in the item or as directed by the Employer. All joints shall be glued with approved adhesive.

Joints shall be strong, neat and shall fit without wedging or filling. They shall be pinned with hard wood or bamboo pins of 10-15 mm dia after the members of the frame are glued and pressed together in a suitable vice-mechanism.

Prior to joining, wood members of frame shall be planed smooth and accurate to the full depth. Rebates, roundings, mouldings, etc. as shown in the drawing shall be done before the members are joined.

All timber items shall be subjected to inspection by the Employer prior to any treatment to be carried out. No item shall be installed it is approved by the Employer.

FRAMES OF DOORS AND WINDOWS:

Size of timber shall be specified in Bills of Quantities. Frames shall be rebated to house the shutter. They may be rebated on both sides or rounded or moulded etc. as per drawing. For single rebate, depth shall be 12.5 MM.

Frames shall be finished smooth to receive paint, polish or any other specified finish. Surface abutting against masonry or concrete must be with anti-termite treatment and a coat of boiling coal tar or any other approved wood preservative or primer applied prior to placing in the final position.

PANELLED SHUTTERS (INCLUDING GLAZED):

These shall be as detailed and specified in the drawing. The thickness of styles and rails shall also be as specified in the drawing. The thickness of panels will be as specified and the type of panel also noted therein.

Styles and rails of shutter shall be made out of a single piece. Lock and intermediate rails exceeding 200 MM in width may be made out of one or more pieces of timber but the width of each piece shall not be less than 75 MM. When more than one piece of timber is used, they shall be joined with a continuous tongued and grooved joint, glued together and reinforced with metal

dowels at regular intervals of 200 MM. The tenons shall pass clear through styles. The styles and rails shall have a 12 MM groove to receive the panel.

Panel may be made out of strips of planks, marine ply built up to required thickness, glass, particle boards etc. and decorated with cover mouldings as per drawing. They shall be joined with continuous tongued and grooved joints, glued together and reinforced with metal dowels or hot pressed in case of built up panels out of plywood, particle boards, prelaminated melamine boards etc. with exterior quality adhesive as per IS. For the fir rated doors, asbestos sheets as infills may be used if approved by the Employer. Sash bars shall have mitred joints styles.

Marine Plywoods, exterior quality particle baords, exterior quality prefinished melamone boards etc. shall be as specified and approved by the Employer. Asbestos sheet panels shall conform to the relevant IS.

Shutters shall not be painted or treated before these are approved by the Employer.

FLUSH SHUTTERS:

Solid core type wooden flush door shutters shall conform to IS 2202 (Part I & II). Doors shall be factory made and approved by the Employer prior to being used.

FITTINGS AND FIXTURES:

All Fittings and Fixtures shall be provided as specified in the drawings and Bills of Quantities. Material and Make of these Fittings and Fixtures shall be as per the drawing. Required brass screws for fixing them in the same colour shall be provided. Fittings and fixtures shall be as approved by the Employer. This shall also include making grooves, chases, reiforcing etc.

COVER MOULDINGS:

These shall be of 1st class Teak and of the shape and size as per the drawings. They shall be fastened with nails and nail holes puttied with putty of colour to match the colour of moulding.

HAND RAIL:

Hand Rail shall be of the 1st class C.P. Teak Wood moulded and of size and shape as per drawing. The bends and rounds shall be made from one piece or as per the Architect. Hand rail shall be fixed to Railing by means of scres.

MEASUREMENT:

Wood work and joinery shall be measured in Cubic Meter, Square meters, Running Meters or any other manner as specified in Bills of Quantities.

The price for an item shall include supply of specified quantity and type of timber, sawn, cut, jointed, framed and fixed in position including supply and fixing of approved anti-corrosive treated fixtures, straps, bolts, hold-fasts, spikes, nails, screws, etc. supplying and applying glue, coaltar, paint and anti-termite treatment. The item shall also include all materials, labour, scaffolding, use of equipment etc.

Fixtures and fitting shall be as specified in the drawing or Bills of Quantities.

If wood work is found to be defective due to bad workmanship, shrinkage etc. within 2 years after completion of work, the defective wood work shall be refixed by the Contractor at his cost to the satisfaction of the Employer. This includes the repairs required to complete the work as it was finished earlier.

- METAL DOORS AND WINDOWS:

.1. INDIAN STANDARDS:

All relevant Standards as specified elsewhere in this volume are applicable

Indian Standards to be followed are:

- IS 226
- IS 451
- IS 733
- IS 737
- IS 1081
- IS 1285
- IS 194
- IS 5523
- IS 6248

.2. ALUMINIUM DOORS, WINDOWS AND VENTILATORS:

1. General

(i) Scope of Work

Supply, fabrication, erection , commissioning and handling over of various aluminium items covered under B.O.Q.and broadly listed as follows:

- Doors
- Curtain wall/Fixed partitions.
- Sliding Windows, Louvered windows.
- Openable and Fixed Windows.
- Pivot Windows.

(ii) Specifications

- Specifications for materials, construction, erection etc. are detailed in subsequent sections.
- The sizes of aluminum sections are mentioned as nominal.
- The contractor shall clearly indicate in his offer;

Profile, dimensions, weight, etc.of various sections offered.

Total weight of Aluminium per item.

Area of glazing and solid panel per item

Total area of glazing and solid panel for al items.

(iii) Drawings and Samples.

Not used.

Samples of sections, anodizing/powder coating, hardware etc. Shall also be submitted upon instructions form the Consultants.

Fabrication work shall be taken up on the basis of approved drawings.

Approval of drawings does not relieve the Contractor of his responsibility to meet with the intents of the specifications.

(iv) Codes and Standards

The materials shall meet the relevant IS code and Standards.

(v) Measurements and Rates

All measurements shall be considered on the basis of out ot out dimensions of each item, corresponding to finished structural opening.

Rates shall be quoted on the basis of each item .

In case due to site conditions out to out measurements are increased/ decreased, the quoted rate shall be adjusted accordingly on pro-rata (M2) basis.

(vI) Site Visits.

The contractor shall visit the site and acquaint himself with the Site conditions prior to taking up fabrication/ erection work.

The contractor shall check the openings and bring to the notice of the Consultants any discrepancies if any prior to fabrication / erection work.

If any template is required for checking openings, the contractor at his cost shall provide the same.

2 General Specifications

(i) Material

All sections shall be made from extruded aluminium of alloy HE-9-WT conforming to IS: 733-1956

Frames and Shutters: Sizes of sections and weights given in subsequent section are nominal. The Contractor shall furnish details as per sections offered by him.

Prior to anodizing; aluminium sections shall be cut to sizes and assembled into frames and shutters.

All notches, cuts, holes etc., shall be made.

Frames/Shutters shall be checked for trueness and then dismantled for taking up anodizing.

50 mm X 25 mmX1 mm. Thick rough ground shall be provided for sliding windows.

Fly mesh shall be S.S. woven type.

Anodizing

Aluminium sections shall be brushed and silver anodized to satin finish as per IS:1868/1968 and shall not be less than 20 microns.

The contractor shall satisfy anodizing thickness by giving necessary tests on random samples selected by Consultants.

Anodized sections shall be provide with protective coating on all exposed surface and properly tagged for identification prior to dispatch to site.

Glazing and Fly mesh

4 mm. Thick clear or forsted Float Glass to be provided unless noted otherwise.

Gray Reflective Glass/tempered glass to be provided wherever directed.

Solid Panels

- P1:- Decorative Laminate finished panels :

Unless otherwise noted, solid panels shall be fabricated form 12 mm. Thick phenol resin bonded Marine ply cladded with 1.5 mm thick decorative laminate of approved make and color on both sides. All edge shall be sealed with T.W. lipping or decorative laminate.

- P2: Aluminum sheet cladded panels :

In case it is specifically noted, these shall be fabricated form 6-mm. Thick phenol resin bonded marine ply cladded with 18 gauge anodized aluminum sheet on both sides pressed and formed, bonded with approved materials, all edges shall be sealed with aluminum sheet.

Glazing Gasket

Glazing gasket shall be of dry type preformed PVC/Neoprene profile to hold glass or solid panel in aluminum frame under pressure. Suitable non-metallic setting blocks shall be used to centralize glass in metal frame.
Rubber gasket shall not be allowed.
Glazing in metal frames shall be done just before handing over.

Weather Stripping

Wherever required soft PVC / Neoprene [reformed pile profile shall be inserted into extruded grooves/pockets in the sections.

Construction

Frames and shutters of hollow rectangular or 'Z' sections shall be mechanically jointed with 3mm. Thick aluminum angle cleats. Aluminum alloy blind or solid rivets and nickel plated self –tapping screws of goods quality shall be used for joints and fittings.
Open or non-hollow 'z' sections frames and shutters shall preferably be flash butt welded.

Erection

Frames shall be fixed/ancohored in brick or concrete openings with brass or nickel plated screw on all sides.

In case opening is larger than frame (as on case of partitions or doors), the vertical members shall be taken up to RCC slab and anchored rigidly.

The c contractor at his cost shall do minor adjustment in openings.

Glazing and removal of protective coating on sections and cleaning shall be done just prior to handing over.

All tools, ladders, scaffolding etc. required for the contractor shall provide erection.

Grouting

All metal frames shall be erected position, fixed and grouted with non-setting polysulphide mastic or equivalent on all sides (from inside and outside) filling all gaps, crevices etc.

3 Detailed Specifcation

Item wise specifications shall be as mentioned herein below. Wherever, it is not mentioned specifically, other specifications shall be as per General Specifications given in Section 2 above.

(i) Doors

Type

Single or double leaves

Single or double swing

Fully or partly glazed partly solid paneled.

With/Without fixed glazing at sides and top

Frame and Shutter

Rectangular extruded sections having in-built grooves to receive glass or solid panel.

Glazing can be flush or with Snap-On aluminium bedding provided with glazing gasket.

Profiles.

Section Description	Nominal Size in mm	Nominal Wt.Kg./RM
Frame-Plain	100 X45X2.5	2.00
Frame-Single groove	100x45x2.5	2.02
Frame-Double groove	100x45x2.5	2.10
Shutter-TOP	44.5x47.5x2.1	1.10
Shutter –Bottom	44.5x114x2.15	2.00
Shutter-Vertical	44.5x47.5x2.1	1.00
Shutter-middle	44.5x100x2.1	2.10
Glazing Clip	20x18x1.2	0.23

Hardware

Door shutters shall be provided with;

Concealed six lever lock having brass body with S.S.key operating from both sides.

150 mm x 6 mm. Thick full shutter wide anodized aluminium handle cum guardrail fixed with S.S. bolts and nuts.

GI pivots at top and bottom.

Concealed shoot bolt at top and bottom for inactive leaf.

Single or double action heavy duty floor spring of Everite/ Garnish/or equal make with S.S.Cover plate or efficient gadget door closer.

(ii) Curtain Wall/ Fixed Partitions.

Type

Fully or partly glazed partly solid paneled.

With / without door/ windows shutters.

Frames

Rectangular extruded aluminum sections having in built grooves to receive glass or solid panel.
Glazing can be flush or with Snap-on aluminum beading provided with glazing gasket.

Profiles

Sections Description	Nominal size in Mm	Nominal Wt. Kg/RM
Top Vertical & horizontal	100 x 38	2.10
Prem.strip	38 x 6	0.36
Cover strip	10 x 6	0.12

(iii) Fixed view Panel

Frames
Rectangular extruded aluminum sections having in built grooves to receive glass.
Glazing shal be flush or with Snap-On aluminum beading provided with glazing gasket.

Profiles

Sections Description	Nominal size in Mm	Nominal Wt. Kg/RM
Vertical and Horizontal	45x45x2.0	1.00
Beading	20x18x1.2	0.23
Tee	25x25x2.0	0.25

(iv) Sliding Windows

Frames

Frames shall be 2/3 tracks as required having in built grooves to accept weather stripping.

Shutters

Framing and interlock sections shall be hollow sections with in –built grooves for weather stripping and suitable for glazing.

Gutters and Valves

Sill member shall be hollow section with special gutter section clipped on to the bottom track to the bottom track to have hollow chamber. PVC vales shall be provided in gutter sections acting as pressure equalization Cum non return valves.

Profiles

Sections Description	Nominal Wt. Kg/RM
2 track top and vertical	0.60
2 track bottom	0.88
3 track top and vertical	0.98
3 Track bottom	1.07
4 Track top and vertical	1.15
4 Track bottom	1.45
Shutter vertical-top and bottom	0.42
Shutter interlock	0.49

Hardware

The sliding shutter shall be provided with,

Needle bearing nylon rollers, to give effective and smooth sliding and bearings concealed n nylon csing.

Integrated flush type handle cum lock having aluminum body and stainless steel spring/ receiving latch.

Nylon end cover cum guide on the top and bottom of shutter.

Nylon anti-lift with pile insert to prevent lifting and tilting of the shutter. Frames shall be fitted with tubular rough grounds.

Constructions

The frame shall be mechanically jointed with 3 mm. Thick aluminum angle cleats.

The shutters shall be mechanically jointed with plated self-tapping screws and aluminum safety plate. Aluminum alloy blind rivets and nickel-plated self tapping screws shall be used for the joints and fittings.

(v) Openable and Fixed Windows.

Frames

The frames shall be equal leg section having in built grooves to accept weather stripping.

Shutter

The shutters shall be side hung, to hung as required and made from hollow 'Z' sections with in built grooves for double weather stripping. Glazing shall be done with rectangular extended aluminum beading proved with gasket.

Profiles.

Sections Description	Nominal size in Mm	Nominal Wt. Kg/RM
Frame & shutter Section	45x45x2.0	0.92
Mullion	45x60x1.7	1.1
Beading	35x20x1.1	0.31

Hardware

The Openable shutters shall be provided with

Concealed type friction S.S.4 bar hinges allowing clearing of glass from both sides from inside and window can stay in an desired position,

Locking shall be tow points with handle or single point as required.

Notes:

All edge members shall be anchored/screwed to brick wall/RCC member on sides and top.

In case of glazed partitions, vertical members shall be taken up to RCC slab bottom and anchored.

All frames shall be grouted as per Technical Specifications.

All components shall be per Technical Specifications.

All doors shall be quoted without door closer/floor spring.

Rates are to be quoted on out to out dimensions of frames. In case of variations in dimensions of frames during execution, rates shall be reworked on pro-rata basis.

Rought grounds shall be provided for sliding windows and shall be included in rate.

Workmanship, hardware, glazing, and other specifications shall be as per Technical Specification and shall form part of Bill of Quantities.

Opening is mentioned from plastered surfaces without rough grounds and area is shown in (M2). Total area per item is also shown against item in (M2)

.2.1. STEEL FRAMES:

Steel frames shall be manufactured out of steel conforming to standard specifications and shall have oxidized fittings. The size of section shall be as specified or shown on the drawings. They shall have fixed all necessary accessories such as eyes, lugs, and hinges etc. as per drawings and Employer's instructions. The welding of joints shall be of full size and grinded neat. There shall be no joints in any member of the frame.

- GLAZING

.1. INDIAN STANDARDS:

All relevant Standards as specified elsewhere in this volume are applicable.

Indian Standard to be followed are

- IS 419
- IS 1081
- IS 2553
- IS 2835
- IS 3548
- IS 5437

.2. MATERIALS:

.2.1. SHEET GLASS:

Sheet glass shall be flat, transparent and clear when judged by the unaided eye. It may, However, possess a tint when viewed edge-wise.

It shall be free from cracks, blisters, stones, scratches, bubbles. Sheet glass shall not show any distortion of light when tested to IS.

Sheet glass shall not have defects greater than those given in IS 2835. Test shall be conducted as specified in IS 2835.

Classification of glass shall be as per IS 2835.

.2.2. PLATE GLASS:

Plate glass is a flat glass formed by a rolling process, ground and polished on both sides,witha surface that in essentially plane and parallel.

.2.3. WIRE AND FIGURED GLASS:

This shall conform to IS 5437.Glass shall not contain any stones and cracks or stones bigger than 2 MM diameter.

In case of tinted glass, colour patches shall not be permitted.

Wired glass shall be 6.4 +/- 0.4 MM thick in sheet form. Wire mesh shall be of steel wire 0.46 to 0.56 MM in diameter. The pattern of mesh shall be square or diamond with wires welded or hexagonal with wires twisted. Wire mesh shall be completely embedded at minimum 1 MM from the surface of glass. Wire mesh shall not contain more than 3 broken wires per square meter of the wire glass.

Wired and wired figured glass shall satisfy the fire proof test prescribed in IS 5437

.2.4. TOUGHENED OR LAMINATD SAFETY GLASS:

This shall conform to IS 2553.

The toughened or laminated glass shall be made of sheet glass of selected quality as detailed in 2835. Glass may be transparent, translucent or coloured as specified.

Glass shall be free from cracks, blisters, stones and scratches, bubbles and other defects which can interfere with vision and service of glass.

It shall conform to uniformity test, fragmentation test, humidity test and fracture and adhesion test as given in IS 2553

.2.5. FROSTED OR OBSCURED GLASS: -

Sheet glass is ground to achieve frosting and obscuring effect. Grounding is done uniformly. Glass is cleaned thoroughly to avoid any stain formation on the surface.

.3. PUTTY: A homogenous paste free from dust, grit and other visible impurities and conforming to IS 419 shall be used.

.3.1. WORKMANSHIP:

The detailed process shall be as specified in IS 3548 for Glazing in buildings and in wood joinery and IS 1081 for Metal Doors and Windows.

Glass for glazing shall allow a clearance of 2.5 MM between the edge of the glass and the surrounding wood or metal.

Size of beading shall be as detailed in IS or as approved by the Employer. Beads shall be secured with shutters with panel pins or screwed.

Sufficient compound shall be applied to rebate so that when the glass has been pressed into the rebate a bed of compound not less than 1.5 MM thick will remain between the glass and rebate. The beads should be bedded with compound against the glass and also be bedded against the rebate.

Care should be taken to see that no voids are left between the glass and the bead.

Steel doors and windows shall normally be glazed with glazing putty on outside unless otherwise specified. Putty shall then be applied over the glass panes, which shall stop 2 to 3 MM from the straight line of the back rebate to enable the painting to be done upto the slight line, to seal the edge of putty to the glass. The oozed out back putty shall be cleaned and cut to straight line. Quantity of putty shall not be less than 185 Gms/Meter of glass perimeter. Putty shall be painted within 2 to 3 weeks after glazing.

.3.2. MEASUREMENTS:

Actual cut size glass shall be measured in Square Meter.

Irregular shaped or circular panes shall be measured as smallest rectangular area from which the irregular or circular pane can be cut.

The rate for various items shall include the cost of material and labour required for proper completion of the item including wastage, breckages involved in process, cutting, cost of subsidiary material required for proper fixing and functioning of glass such as nails, spirits etc. This shall also include carriage, hoisting scaffolding etc.

Glazing shall be measured as part of door, windows, ventilators, etc. unless specified otherwise in the Bills of Quantities.

- PAINTING AND POLISHING:

.1. INDIAN STANDARDS: All relevant Standards as specified elsewhere in this volume are applicable.Indian Standards to be followed are:

- IS 79
- IS 345
- IS 348
- IS 427
- IS 428
- IS 533
- IS 1477 (Part 1 & 2)
- IS 2338 (Part 2 & 2)
- IS 2395 (Part 1)
- IS 2932
- IS 2933
- IS 3140
- IS 3537
- IS 3631
- IS 4597
- IS 5410
- IS 6005
- IS 6278
- SP 27
-
-

.2. MATERIALS

.2.1. PAINTS:

Paints used in the works shall conform to the respective IS and code of practices. These shall be the latest revised.

Paints shall be factory-made and no site preparation shall be allowed except for the white-wash. Paints received at the site shall be in the manufacturer's sealed drum.

Paints should be such as to withstand weathering effects of the atmosphere, decay of wood, Corrosion of metal and of pleasing appearance. Also their surface should become hygienic, clean and attractive.

Paints shall conform to the following points:

a) Good spreading coverage
b) Easy application
c) Should form a thin uniform film on application
d) Surface should not crack when paint dries
e) Should be inert to weathering actions of atmosphere
f) Final surface should hard and durable.

Manufacture and shades of Paints used at work site shall be to the approval of Employer.

.2.2. VARNISHES:

Varnishes shall conform to the respective latest revised IS. Varnishes shall create a

Brightening appearance on wood, brilliancy to the painted surface and after protection against atmospheric action. Good varnishes should achieve the following:

a) Render glossy/matt finish to the surface as specified.
b) Have an uniform, pleasing appearance on rapid drying
c) Its colour should not fade
d) Must ensure, a final hard, durable and tough surface.

.3. WORKMANSHIP:

.3.1. CONCRETE, MASONRY AND PLASTERED SURFACES:

Work shall be carried out as specified in IS 2395, Part I & II. Schedule of painting system to be as per IS. 2395 Part II.

.3.1.1. SURFACE PREPARATION:

a) Surface shall be cleaned and any existing fungus or mould shall be removed. A coat of fungicidal wash shall then be applied and allowed to dry.

b) Any cracks, defects in plaster or concrete shall be cut out, made good, cured and allowed to dry. Minor cracks may be filled with a suitable filler.

c) In case of an old surface, previous paints or any other coats shall be totally removed prior to any repaint. If a painting system that is the same as the old one is to be installed, then complete removal may not be necessary. They shall be washed and light-sanded as approved by the Employer.

d) Lime mortar plaster shall be left unpainted for the first few months to allow plaster to carbonate, harden and dry thoroughly.

e) In case of Gypsum plaster it shall be ensured that the surface is either alkaline or neutral and tested in accordance with E-1 as specified in IS 2395

f) In case of masonry, joints shall be brought to a sound condition before the painting operation is started. Brick work painting shall be deffered at least by 3 months.

All paints and products shall be procured from one manufacturer only. The steps for

painting operation to be followed are as under:

a) Primer/Sealer- coat as recommended by the paint manufacturer

b) Filler/Putty-as many layers as required and approved of

c) Under coats

d) Finishing coat or coats

Paints to be applied shall be spread uniformly over the entire area.

Paints shall be mixed and stirred thoroughly prior to use. No adition of thiner or water shall be permitted other than the quantity specified by the manufacturer.

Paint may be sprayed or applied with brush depending upon type of paint used.

Finishing shall be to the satisfaction of the Employer.

Sufficient time shall be allowed between two coats to ensure that the earlier coat is fully dry prior to the application of the successive coat.

Application of paint shall be carrid out in properly ventilated and dry weather,

.3.1.2. WHITE WASH:

Lime of class 'c' shall be slaked at site by mixing and stirring 1 Kg unslaked lime to 5 litres of water to make a thin cream. This shall be allowed to settle for a day and then screened through a clean coarse cloth. 4 Kg gum dissolved in hot water shall be added to each cubic meter of lime cream. A small quantity of ultra marine blue (upto 3 gm. Per kg of lime) shall also be added to the last two coats of white wash solution and whole solution shall be stirred thoroughly before use.

Application of one coat in one room shall be finished in one operation.

.3.1.3. COLOUR WASH:

Colour wash shall be prepared by adding mineral colours, not affected by lime, to white was. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Employer

.3.1.4. CEMENT PAINT:

Cement paint shall be water proof and shall be applied over thoroughly wetted surfaces. It is important that painted surfaces shall be sprinkled with water two or three times a day for 7 days.

Brushing of paints in coats shall be in a direction that is at right angles to the previous one. No brush mark must be visible. The finished surface shall be to the acceptance and approval of the Employer. Any additional coats required to achieve this shall be to the account of the Contractor and no extra charges shall be payable for any additional coat appllied.

.3.1.5. MEASUREMENTS:

Painting shall be measured in Square Meter with respective factor as per SP 27.

.3.2. WOODEN SURFACES:

Work shall be carried out to specifications in IS 2338 Part I and Part II The system shall be installed as per the schedule for finishing and shall be as per IS 2338 Part II.

.3.2.1. SURFACE PREPARATION:

a) Wood to be painted shall be seasoned and free from discoloured sapwood and from large resinous or loose knots.
b) Nail shall be punched well below the surface to provide a firm key for stopping.
c) Moulding shall be carefully smoothened with abrasive paper and the fibres left after machining shall be cleaned and removed.
d) Flat portions shall be smoothened.
e) Any knot, resinous streaks or bluish sapwood shall be treated with two coats of pure shellac knotting, applied thinly and extended to about 25 mm beyond the actual area required treatment.

.3.2.2. PRIMING:

a) Dirt or any other extraneious materials shall be removed. A priming coat shall be aplied to the bare wood.
b) All exposed surfaces of the wood shall be primered.
c) Unless specified otherwise, all joinery work which is intended to be painted shall receive at least two priming coats.

.3.2.3. STOPPING AND FILLING:

a) Stopping and filling shall be carried out only after priming. Filer material shall conform to IS and shall be as approved by the Employer
b) Filler of stiff paste shall be applied with putty knife to fill holes and cracks and subsequently rubbed down to a level surface with abrasive paper, pumice stone or other suitable abrasive material.
c) The filler coat shall be of an optimum thickness and shall be allowed to fully harden and flatten before the subsequent coat is applied. As many layers as necessary shall be applied allowing sufficient time between the coats to harden and flatten

.3.2.4. UNDERCOATS:

a) The undercoat shall beapplied after the surface has been primed, stopped, filled and rubbed down to a smooth surface.
b) The under coat may be brushed or sprayed.
c) After drying, the coat shall be carefully rubbed down and wiped clean before the next coat is applied.

.3.2.5. FINISHING:

The application of finishing paint varies according to the type of paint employed. Cleanliness is essential and as far as possible the application shall be carried out in a normal dry condition The finishing coat may be applied either with brush or may be sprayed.

.3.2.6. MEASUREMENTS:

Measurements shall be in Square Meters with respective factor as per SP 27.

.3.3. CLEAR FINISHES FOR WOOD SURFACES:

Clear finishes shall be applied to wood and wood based interior surfaces. They shall be carried out to IS 2338 Part I. The procedure of application shall be as detailed hereafter.

.3.3.1. FILLING:

a) Filler conforming to IS 345 shall be used to level off, to make smooth, to prevent the excessive penetration of the finish and to fill the open cells.
b) For special stain effects colour fillers shall be used.
c) On fine textured woods having minute pores that do not require filling, thin varnishes, lacquer or shellac may be used.

d) Filler or stain filler shall be applied by had using hessian or jute rag across the grain. The filled surfaces shall be dried preferable overnight and smoothened with abrasive paper.

.3.3.2. STAINING:

a) Staining of wood shall be restored to create special effects for subsequent clear finish.
b) Stains used shall be water-based, spirit –based or oil-based as approved by the Employer according to the purpose and location.
c) Surfaces shall be kept scrupulously clean and free from greasy finger marks.
d) Small cracks or nail holes shall be stopped with fine plaster of paris or suitable stopping
e) Stains may be applied by brushing and wiping or spraying. Application shall beliberal but without over-saining that may spoil the stained surface.

.3.3.3. SEALING:

A suitable seal shall be applied on the filled and sanded surface to prevent absorption by the wood of successive coats of finish and to seal stain and filler and thus preclude their bleeding into the finished coat.

When fully dry, the surface shall be sanded taking care not to cut through at corners and edges. Dust shall be blown off and the surface wiped with a clean rag.

.3.3.4. VARNISHING:

a) Surfaces to be varnished shall be prepared to produce a smooth, dry matt surface
b) Previous coats or stains, if any, shall be allowed to dry and rubbed down lightly, wiped off and allowed to dry.
c) Varnish shall be applied liberally with a brush and spread evenly over a portion of thesurface with short, light strokes to avoid frothing.
d) Excess varnish should then be scraped out of the brush and the first section to be crossed, recrossed and then laid off lightly. Too much or too little vanish left on the surface will mar the appearance of the finish. Once the varnish begins to set, it shall not be retouched. If there is any mistake, the varnish shall be removed and redone.
e) Sufficient time shall be allowed in subsequent coats for the previous coat to harden and dry.

.3.3.5. MEASUREMENTS:

Work shall be measured in Square Meters with respective factor as per SP 27

.3.4. FRENCH POLISH:

Work shall be carried out to IS 2338 Part I & Part II.

Pure shellac varying from pale orange to lemon yellow colour, free from resin or dirt shall be Dissolved in methylated spirit at the rate of 0.15 Kg of shellac per litre of spirit. Suitable pigment should be added to get the required colour.

All unevenness shall be rubbed down to smoothness with sand paper and the surface shall be well-dusted. The pores in wood shall be filled up with filler made of a paste of whiting dissolved in water or methylated spirit. Otherwise the french polish will get absorbed and a good gloss will be difficult to obtain.

A pad of woollen cloth covered by a fine cloth should be used to apply the polish. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles so that the polish is applied uniformly over the entire area to give it an even surface. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean cloth, slightly dampled with methylated spirit and rubbed lightly and quickly with clear motions. The finished surface shall have a uniform texture and high gloss.

.3.4.1. MEASUREMENTS:

Measurements shall be in Square Meters with respective factor as per SP 27

.4. FERROUS METAL SURFACES:

Ferrous metal surfaces shall be painted in accordance with IS 1477 Part I and Part II. Partly or fully pre-fabricated material shall be pre-treated only at the factory with specified primers after the required and controlled surface preparation. The painting system shall be as per

IS 1477 Part II.

.4.1. PREPARATION OF SURFACES:

a) It is most important to prepare the surface as per the various methods detailed in IS 1477 Part I and IS 6005 depending upon the material to be painted and maintained.

b) Types of method employed are:
   - i) Petroleum solvent cleaning
   - ii) Trichloroethylene cleaning
   - iii) Alkaline cleaning in process tank
   - iv) Emulsion cleaning
   - v) Electrolytic and steam cleaning
   - vi) Mechanical cleaning (Scraping)
   - vii) Flame cleaning
   - viii) Sand-blasting or Shot-blasting
   - ix) Chemical cleaning (Picking)

c) The best methods shall be used at the respective locations:
   - i) All structural steel shall be sand or shot blasted at site.
   - ii) All pre-fabricated and primed materials shall be mechanically cleaned.
   - iii) All galvanized steel products shall be cleaned and washed with etching or wash primer

d) All surfaces shall be thoroughly cleaned, degreased, derusted, descaled, etc. But care shall be not to do it excessively. All accessible weld flux and splatter shall be removed by power tools.

.4.2. PRIME COAT:

Immediately after the preparation of the surface, the first coat of primer by spray or brush shall be applied ensuring continuous film without "holidays". After the first coat is hard dry, the second coat shall be applied so that a film free from "holidays" is obtained.

.4.3. FILLER COAT:

After the second coat of primer is hard dry, the surface shall be rough sanded without scratching or damaging primer. Dents shall be filled with a putty knife pressing firmly into the dents and applying an optimum layer. The coat shall be allowed to hard dry and cut down by wet rubbing to a smooth finish. As many coats of filler as required shall be applied but each layer must be allowed to hard dry and rubbed smooth. After the last coat of filler is hard dry and wet rubbed a coat of filler by brush or spray to fill the fine dents shall be applied as required.

.4.4. UNDERCOATS:

The entire surface shall be wet rubbed cutting down to a smooth uniform surface. The water shall be allowed to evaporate. An optimum coat of undercoating by brush or spray, shall be applied with minimum brush marks. The film shall be allowed to hard-dry, and then wet-rubbed, cutting down to a smooth finish (ensuring that at no place shall the undercoat be completely removed).

.4.5. FINISHING COAT:

The first finishing coat shall be applied by brush or spray and allowed to dry. Then the gloss shall be gently removed from the entire surface. The surface will be dusted and the second finishing coat applied by brush or spray.

.4.6. MEASUREMENTS:

Work shall be measured in Square Meter with respective factor as per SP 27

.5. POINTS TO BE NOTED:

.5.1. SCAFFOLDING:

The Contractor shall provide, erect and remove all the required scaffolding. It should be free of surface and easy to work. It should be rigid andsafe.

.5.2. PAINTING EQUIPMENT:

All the Brushes, Spraying Machines, Tools, Plants, etc. used shall conform to their respective code of practice. They shall be maintained and serviced regularly as specified.

.5.3. PAINTS:

The paints used shall be procured from one manufacturer for the system installed. They shall conform to Indian Standards,

.5.4. DRYING TIME:

It is essential that each coat shall be thoroughly dry before the subsequent coat is applied.

.5.5. FLATTING DOWN:

Flatting down of primer coat, undercoat, and the first finished coat is essential to provide a key for the subsequent coats in order to improve the inter-coat adhesion.

.5.6. MIXING BEFORE APPLICAION:

Paint shall be applied only after the content of the drum are thoroughly stirred. Paint, while in use, shall also stirred from time to time to ensure that the pigment remains in suspension.

.5.7. THINNER OR DILUTIONS:

Paint manufactured to IS shall have correct consistency and shall not require any further dilution. If there is doubt, the viscosity of the paint may be checked. If slight adjustment to the viscosity is necessary, use the thinner as recommended by the manufacturer of the paint.

.5.8. ENVIRONMENT:

Painting operation should be carried out in a well-ventilated place, free of dust, draught and direct sunlight. In coastal regions and areas with moderate or high humidity, it is generally not safe to paint exteriors in the early morning hours. Painting during the monsoon shall be avoided both in the exterior and interior, as humidity is high which will effect the drying, resulting in paint defects.

.5.9. SURFACE:

Paint surface should be clear of dust, grease, oil, alkalinity, fungus and totally dry.

.5.10. FINISHING:

Paint coats and systems specified are for guidance. Finishing shall have to be carried out to the entire satisfaction of the Employer. If any defects are noticed later, the Contractor shall repair the same or re-install his complete system as required under the Contract. Additional coats, if required, shall be carried out over the minimum specified finish to the approval of the Employer and shall be at the cost of the Contractor and no additional chrarges shall be payable.

.5.11. RATE:

The Rate shall include the cost of all materials, labour, scaffolding, and protective measures involved in all operations described in workmanship and of the item of Bills of Quantities. It shall also include, unless otherwise stated, conveyance, delivery, handling, unloading, storing, waste, return of packing etc.

PREAMBLE

A : PLASTERING

The following shall not be measured separately and shall be deemed to be included in the rates quoted.

1. Work in narrow widths, bands, cornices and small quantities.
2. Work on any surface such as brick, concrete, stone etc.
3. Preparation of surfaces by hacking, raking out joints, wetting the surfaces etc.
4. The thickness of plaster key in joints etc.
5. Arises, drips, grooves, chamfers of a certain width, internal rounded angles, external rounded angles, rounding off corners, etc.
6. Providing grooves at the junction of plaster with other finishes, junctions of filler walls as called for.
7. Scrubbing surface of plaster for key where the surface is not required to be finished fair.
8. Marking of tile module with cement plaster and removing the same before doing the actual tile work.
9. Keeping the work well wetted for at least ten days.
10. Work at all heights, depths and locations.
11. Work on all profiles.
12. All corners, angles and junctions shall be made truly vertical or horizontal as the case may be, and shall be carefully and neatly finished including, rounding of corners and junctions where required without any extra payment.
13. The items of plastering shall be applicable to all kinds of surfaces over which it is directed to be executed. No extra claim shall be entertained due to small or scattered work, difficult positions, heights, extra thickness required owing to original surface being rough or if out of plump etc. Edges of switch boxes, junction boxes, and other service fittings shall be finished neatly as approved by the PMC/Architects without any extra cost.

B: PAINTING AND FINISHES

The following shall not be measured separately and shall be deemed to be included in the rates quoted.

1. Work at all heights and use of scaffolding, trestles, ladders, cradles, etc. necessary for execution of work and for inspection.
2. Preparing surfaces to receive finishing coats, such as brushing, sand papering, scraping, washing and rubbing etc.
3. Putting, sand papering and dusting of surface in between coats where applicable.
4. Work on cornices, narrow widths, bands etc.
5. Finishing approving mat texture and/or stippling finish as called for.
6. Spreading and removing covering to doors, windows, floors fittings etc. to protect them from splashes.
7. Washing floors, cleaning glass, joinery, electric fittings, etc. of drops and splashes and leaving premises clean and tidy.
8. Producing the approved shade of paints by blending different appropriate colours of paint and Steiner.
9. Work on all profiles.
10. Where walls are specified to be painted all columns arises, grooves, rough surfaces, reveals, soffits return etc. shall be included and no extra shall be payable.
11. The rates for painting/polishing shall include work at any height and of any description, taking down cleaning as directed, refixing blinds and fittings, picture rods, cornice poles and small items of ironmongery etc. [not painted] such as door knobs, figure plates, hooks, etc. which are not required to be painted, use of dust sheets and other coverings for the protection of fixtures, fittings, furniture, etc. work in patches including matching with existing work and marrying in at the edges, removing all

splashes, drops, dirt, etc., that may result from the execution of sanitary work leaving premises in a clean state.

12. The costs of all materials, tools, scaffolding, making grooves and other operations as necessary for completion.

13. No deduction in painting/polishing of doors, windows and ventilators shall be made for areas of fittings/fixtures such as finger plates, kicking plates, vision panels etc. but nothing extra shall be paid for leaving all fittings/fixtures in clean and tidy condition. Nothing extra shall be allowed for using different shades on frame and shutter or on two sides of same shutter. The rates quoted for cement based paints/silicon paints shall also be applicable for all surfaces, external and internal, and also on pointed exposed brickwork, cladding work, tile work and concrete work, etc. and nothing extra shall be payable for rough surface.

14. The rate quoted for Snowcem shall be applicable to all the plastered surfaces, concrete surfaces and also rough cast plastered surfaces. No substitute brand may be used unless approved by the Architects.

15. All kinds of surfaces over which oil bound distempering is directed to be executed. No extra claim shall be entertained due to small or scattered work, difficult positions. Edges of switch boxes, junction boxes and other service fittings shall be finished neatly as approved by the Project Management Consultant/Architect without extra charge.

C. DOORS AND WINDOWS AND GLAZING

The following shall not be measured separately and shall be deemed to be included in the rates quoted.

1. All plugs, screws, nails, pins, keys and such other fixing accessories.
2. Mild steel holdfast welded or screwed to frame as shown embedded, anchoring the same in concrete etc. in support walls/concrete members.
3. Expansion bolts/raw bolts and machine screws for fixing to supports as approved by the Architect.
4. First class teakwood lipping to all edges of boards/shutters.
5. Rebates as shown for double leaf shutters.
6. Filling and finishing neat gaps around frames with approved mastic or polysulphide sealant.
7. Glazing putty and clips.
8. Work at all heights and locations.
9. All outer surfaces will be sealed by polysulphide sealant.
10. Refinishing of surfaces damaged by any cause prior to handing over to the client.
11. Cleaning of all surfaces.

D. FLOORING, SKIRTING, DADOES AND PAVINGS

The following shall not be measured separately and shall be deemed to be included in the rates quoted.

1. Use and waste of all temporary fillets, side forms, templates, moulds, straight edges etc.
2. Final preparation of the base, sub-grade or sub-floor including minor trimming of the base to remove slight undulations, only if necessary.
3 Before spreading the under layer, the base shall be cleaned of all dirt, laitance, loose material etc. well wetted and covered with a coat of cement slurry by using a minimum cement content of 2.75 kg. per sqm. area.
4. Providing bedding layer of mortar as specified in the case of slabs, tiles, etc. to correct levels or slopes as called for.
5. Cutting, rubbing and polishing where applicable.
6. Rounding off corners, edges, and junctions of floors with skirting or dado.

7. Work in narrow widths and at all heights and locations and in curved profiles as shown unless otherwise mentioned.
8. Curing, protecting and cleaning all finished surfaces as specified.
9. All relevant points specified under "concrete work - plain and reinforced" shall be applicable to all cement concrete work occuring under "Flooring and Paving." The cost of submitting samples of flooring for approval of the Architect for the area and the location as directed by the Architect are included in the rates.
10. The rate of all different types of flooring/skirting/dado facing work shall be inclusive of all respective types of materials as specified, labour required for all the operations described and required for obtaining proper finish including all tools and plants temporary shuttering, scaffolding, planking, etc., complete.
11. Rate shall also be applicable for small or scattered work difficult positions, for all heights, extra thickness of mortar or flooring material, slabs required owing to the original surface being rough and uneven.
12. Protection of all flooring against any damage, discolouration, etc. finishing of all the junctions between the floor and skirting as desired by the Architect/PMC and shown in the drawings, including covering if asked for providing necessary grooves between skirting/dado with the plastered surfaces including the junctions at wooden frames, as required complete. Finishing the edges of sunken floors of bathrooms/shower portions to the required proper finish [no extra charges will be paid for the same nor the thickness of the exposed portion will be measured].
13. Finishing the edges of switch boxes, junction boxes, and other services fittings neatly as approved by the PMC/ Architect [the area covered by these boxes and fittings shall not be deducted.
14. In case of veneer work/glazed tile dado wherever the junction boxes and other fittings are provided the tiles/stone shall be properly cut and placed to match the edges of these boxes as directed by the PMC/ Architect without any extra charges.
15. Preparation of samples for all the various types of flooring/dado/skirting/facing work for approval of the Project Management Consultant/Architect before commencement of each and different items.
16. Making adequate set-backs and other arrangements in walls to allow for fixing skirting whose faces will be flush with the wall face.

LIST OF APPROVED MATERIALS & SUPPLIERS The approved list gives the makes for various materials – these makes should be followed unless specified otherwise in the item.						
NO.	MATERIALS	MAKES	Series	Code No	Colour	Image
1.	MDF	6mm, 12mm, 19mm, 25mm thick external grade Nuwud or equivalent.				
2.	Teak Wood Beading / Lipping	CP Teak				
3.	Glass	Saint Gobain, Modiguard				
4.	Glass Film	3M science or equi.				
5.	Antistatic / Vinyl flooring (2mm thk.)	Armstrong, Krishna Vinyl.				
6.	Vertical Blinds	VISTA LEVOLOR				
7.	Sun control film	GARWARE				
8.	WALL PAPER / 3D WALL PAPER	Marshel, Green, Spin decor				
9.	ACOUSTICAL FABRIC WALL COVERING	ANUTONE, Armstrong				
10.	ARTIFICIAL GRASS	NAM Grass, Field Truff				
11.	CEMENT BOARD	Shera Wood, Visaka, Bison				
12.	Fabric for chair and sofa	Wipro, Godrej or equi.				
13.	Cement	ACC, Ultratech,Birla shakti				
14.	Flush doors	Anchor, chetak, national/ Everest gold/century ply.				
15.	Paints	Asian, Nerolac				
16.	Cement Paint or external paint	Apex				
17.	Waterproofing	India waterproofing co., Likproof India pvt. Ltd. : Fairmate, Impermo, Cico No.1,				
18.	White cement	Birla, J.K				

19.	Cement Admixtures	(Plasticisers,Fairmate, Fosroc, Sika, MC Bauchemie hardness, retardant etc.)				
20.	Putty	Goldsize (Shalimar paints)				
21.	PVC door - make	sintex				
22.	Hardware	Shalimar, CIEF, Vijayan Navbharat Brass works, sobit or approved equivalent.				
23.	Screws	G.K.W. Nettefold, Oxidisedor approved equivalent.				
24.	Adhesives	Fevicol, SH, Movicol, HV Vamicol, Pidilite.				
25.	Edge Finish for laminated furniture	2mm PVC/ABS(Poly Vinyle Chloride /Acrylonitrile Butadiene Styrene) edge bands				
26.	Edge Finish for veneered furniture	6 mm thk Burma teak lipping				
27.	Locks	Godrej, Sobit, Vijayan or approved equivalent.				
28.	Admixtures	MC Bauchemic, Krishna Conchem products Pvt. Ltd., Pidilite, CIDCO or approved equivalent.				

No	Location /Proto type	Material	Type	Shade/ finish	Makes	Product image
30	Hardware -	Handles – 250/300 mm	SS	brush finish	Kich/ Hafele / Hettich/ Ozon or equivalent	
31	Hardware Furniture	Handle –100 mm/ 64 mm	SS	Brush finish	Kich CH A10/Hafele / Hettich / Ozon or equivalent	
32		Drawer sliders – work cabinets	SS	Brush finish	Ebco / Hafele / Hettich / Ozon or equivalent	
33.		Telescopic sliding channels for drawers	SS 304/316	Brush finish	Kich / Hafele / Hettich / Ozon or equivalent	
34		Spring Hinges for cabinets	SS 304/316	Brush finish	Ebco/ Hafele / Hettich / Ozon or equivalent	
35		Floor mounted spring hinges	SS 304/316	Brush finish	Ozone/ Hafele/ Hettich or equivale nt	

No	Location / Proto type	Material	Type	Shade/ finish	Makes	Product image
36		Drawer locks	SS	Brush finish	Godrej / Hafele / Ozon or equivalent	
37		Drawer system Lock	SS 304/316	Brush finish	Ebco / Godrej or equivalent	
38		Cabinet Lock	SS 304/316	Brush finish	Hafele / Godrej or equivalent	
39		Door Lock	SS 304/316	Brush finish	Hafele / Godrej / Ozon or equivalent	
40.	Wooden partitions with Hilux Calcium Silicate board finish	wood work in frames of false ceiling, Floor, partitions etc. sawn and fixed in position (Sal wood)	Sal wood carcass with12 mm ply fixed on either side finishing with 8 mm thk Calcium silicate boards	Lustre finish Acrylic emulsion paint of approved colour and shade.	Hilux calcium silicate boards Paint – Asian Paints or equivalent	

Acoustic and Interior Work

1	Synthetic wool	Thermally bonded compressed FR rated Polyester fibre sheet or roll of given GSM	Mikron / Reliance/ Anutone/ approved equivalent
2	Gypsum board	12 mm thick gypsum board	Gyprock / Boral/ Knauf / approved equivalent
3	Gypsum board perforated	12mm thick perforations 8/18 mm	Saint Gobain Rigitone 8-18 / Knauf Solopanel 8-18 / approved equivalent
4	GI frame system		Gyprock/ Techno acoustics
5	Carpet	100% stain proof FR grade synthetic carpet of given GSM (fabric weight)	Barber Point / Piccolo/ Premium/ Unitex/ Nexgen /approved equivalent
6	Wood-wool board	Cement or magnesite bonded wood wool board FR rated having density of 400kg/cu m or more.	Heradesign / AMF/ Anutone/ fibrecrate/ Balaji/ approved equivalent
7	compressed polyester fibre Non woven pads	made from FR rated fibres thickness 9mm & density 200 kg/ cu m or more	Technoacoustic/ Anutone slim plus / approved equivalent
8	Fabric	FR rated decorative fabric	A to Z, Reliance/ Nexgen/ Respons sample to be approved
9	Compressed Soft-Fiber ceiling tiles 15mm	ceiling tiles made from Compressed bonded glasswool density 100 kg / cu m or more, having NRC 0.8 or more	Ecophon Advantage E/ Armstrong Optra/ Anutone Subtex
10	T Grid		Armstrong/ Ecophon/ Techno Acoustics
11	Ply Wood (water proof) 12mm & 18 mm		Kit Ply, Green ply, Century, Superflux or approved equivalent
12	Veneer 4 mm		Green Lam, century, Formica or approved equivalent
13	Laminate 1 mm		Green Lam, century, Formica or approved equivalent
14	Processed Rubber wood		Agrowood, Arowwood, Rosewood or approved equivalent

AV System

Sr. No.	Description	Make
1	12" Powered Speaker	ElectroVoice ZLX 12P
2	Speaker mounting System	Custom
3	16 Channel Mixer	YAMAHA MGX
4	10 Channel Mixer	YAMAHA
5	Wireless Headset Microphone system	Shure/Sennheiser
6	Microphone Cable .5 sq mm 2 core shilded including PVC piping	Reputed
7	HD / WUXGA laser Projector	Epson EB L630SU
8	110" 16:10 Projection motorized Screen	Logic / Crystal
9	Heavy duty projector ceiling mount kit	Logic/Crystal
10	HDMI cable 4k/WUXGA 20 meter	Reputed
11	Tablet	Reputed
12	100" smart display	Reputed
13	HDMI cable 20 meter	Reputed

AV System

S.No.	Description	Make	Model
A	**Audio System**		
1	**Line Array Speaker:**	Electrovoice	EVF-1152S 94
2	Mounting/hanging arrangements for above speaker cluster	Custom	
3	**Passive loudspeaker for Stage Monitors:**	Electrovoice	EKX-12
4	**Power Amplifier:**	Dynacord	L3600FD
5	**Power Amplifier:** s	Dynacord	L1800FD
6	**Digital signal Processor :**	Bose	ESP-880A
7	**Mixer:**	Yamaha	MGP16X
8	**Podium Microphone :**	Electrovoice / Shure	CVG 18
9	**Wireless Handled Microphone:**	Electrovoice / Shure	R300-HD
10	**Head worn Microphone:**	Electrovoice / Shure	R300-E
11	**Vocal Microphone:**.	Electrovoice / Shure	ND76S
12	**General Microphone:**	Ahuja	101 XLR
13	**Microphone Stand** long type	Ahuja	
14	**Microphone Stand Table type**	Ahuja	
15	**Speaker Cable:**2 conductor 14 AWG	Liberty AV	14-2C-BLK
16	**Mic Cable:** 2 conductor 22 AWG stranded	Liberty AV	22-2C-SH-GRY
17	**Equipment Rack:** 32U Equipment Rack	Customised	22U
B	**Video System**		
18	**Projector :**	EPSON	EB-L 630 SU
20	Mounting/Hanging arrangements for above projector	Custom	
21	Motorised Projection screen tab tensioned of 240" having aspect ratio of 16:10	Suvira	

22	**4x2 Matrix switcher:**	Liberty AV	DL-S42-H2
23	**HDMI Wall Plate:**	Custom	
24	4K HDMI 2.0 Tranmitter Receiver Set - 70 m	Liberty AV	DL-HD70LS-H2
28	**Distribution amplifier/splitter 1 x 4;** HDMI 2.0	Liberty AV	DL-HD14-H2
29	HDMI - HDMI 02 M cable	Liberty AV	HALO-HC02M
30	USB A to B cable	Liberty AV	E-USB3AB-06
31	Twister pair cable	Liberty AV	24-4P-L6ASH-BLK
32	12 Port XLR Junction Box	Custom	Custom
33	12 Port Network Switch PoE	Reputed	Repued
34	Connectors and patch cables	Reputed	

TECHNICAL SPECIFICATIONS FOR HVAC

SCOPE:

The scope of this section comprises the supply, erection, testing, adjusting & commissioning of DX System.

CONDENSING UNITS:

SCOPE:

The scope of this section covers supply, installation, testing, adjusting, and commissioning of Condensing Units.

AIR HANDLING UNITS:

SCOPE:

The scope of this section comprises the supply, erection, testing, adjusting and commissioning of double skin air handling units, conforming to the specifications and in accordance with Basis of Design, Requirement of drawings, AHU Summary Sheet and Schedule of Quantities.

ACCESSORIES:

Each air-handling unit shall be provided with DX cooling coil as per Condensing unit configuration. In addition, the following accessories shall be required at air handling units, as described in the schedule of quantities and are to be provided by the HVAC Vendor.

a) Thermostat (located in the return air path) will control the operations of the Condensing units connected with the respective Air Handling units.

b) Insulated Refrigerant piping and condensate drain piping, upto sump or floor drain in air handling unit room, shall be installed as described in section "Piping".

c) Prefilters shall be minimum 50mm thick and shall also be fire retardant type, washable media with 90% down to 10-micron efficiency filters.

PERFORMANCE DATA:

Air handling units shall be selected for the lowest noise level of the equipment. Fan performance rating and power consumption data with operating points clearly indicated shall be submitted with the tender or during execution stage to the Consultants and get prior approval from them.

This performance is to be verified at the time of testing and commissioning of the installation. Noise level at 1 meter from the AHU shall be less than 65 dBA.

TESTING:

Cooling/Heating capacity of various air handling unit models shall 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 accurately calibrated. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

REFRIGERATION SYSTEMS:

DX SYSTEMS:

OUTDOOR UNITS (CONDENSING UNITS):

The outdoor unit shall comprise of following facilities:

Condenser fan(s)

Constant speed scroll compressor

Air cooled Condenser coil

Resin based grille

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

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

The Compressor shall be high EER, high efficiency compliant INVERTER SCROLL design. (For outdoor units upto 3TR (Hi-wall Split Units) the machines shall be with reciprocating/ rotary compressors). Each compressor shall have rotolock valve for service purpose and with in-built overloads, HP and LP Controllers. The compressor shall be mounted on vibration isolators/rubber grommets. Pressure gauge ports shall be provided in each compressor.

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

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

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

The outdoor unit shall be factory charged with the necessary CFC Free refrigerant. Additional refrigerant charge shall be added, as per the site conditions and as per recommended by the manufacturer, during the commissioning procedure.

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

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

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

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

The Unit shall have its' own Isolator for electrically isolating the Machine during emergency or maintenance.

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

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

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

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

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

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

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

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

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

Low voltage and high voltage protection for microprocessor control.

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

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

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

INDOOR UNITS:

The following models of indoor units shall only be acceptable:

Ducted Horizontal

Hi-Wall Mounted type

Cassette type

Package Units

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

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

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

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

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

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

The refrigerant pipe terminations shall be fitted with flared connections, complete with flare nuts.

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

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

The indoor unit shall be suitable for a power supply of 240V/ 1 phase/ 50Hz OR 415V / 3 phase / 50Hz OR 415V/ 3 phase/ 50Hz as per the size selected.

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

AIR-COOLED VRF/VRV SYSTEMS:

SCOPE: The scope of this section comprises the supply, erection, testing, adjusting and commissioning of complete VRV / VRF/ SET FREE / MMS Package systems comprising of Outdoor Units with rotary scroll compressor(s) suitable for outdoor installation and Indoor Units both controlled by full function microcomputer controller system.

DESIGN BASE: The tender drawings indicate a system based on a selected manufacturer of equipment and the design data available to the consultant during the document preparation. Electrical services, size, configuration and space allocations are consistent with that of the manufacturer's recommendations and requirements.

Other listed or approved manufacturers are encouraged to provide equipment on this project; however, it shall be the contractor and/or supplier's responsibility to assure that the equipment is consistent with the design base.

GENERAL REQUIREMENTS: The system shall comprise of Outdoor Units with Air-cooled condenser, high pressure Scroll Compressors with motor, assembled and wired in a single package complete, starting controls, safety controls, operating controls and with full feature microcomputer based controller with real time clock and programming / diagnosis facility. The unit is to be given a complete factory operating and control sequence test under load conditions with fluid hooked up, and is to be shipped with full operating charge of refrigerant and oil. Air-cooled Condenser, refrigeration piping controls, first charge of refrigerant etc.

REFRIGERANT: The refrigerant used in the system shall be environmentally friendly, CFC free gas either R407C / R410A refrigerant or any other CFC free variant as per approved by the HVAC Consultant.

GENERAL DESCRIPTION: THE MULTI-PIPE SYSTEM SHALL BE AN AIR COOLED, MULTI ZONE, AND VARIABLE REFRIGERANT FLOW (VRF) SYSTEM. THE VRF SYSTEM SHALL BE OF THE INVERTER SERIES SUITABLE FOR COOLING OPERATION. REFER TO SCHEDULE OF EQUIPMENT FOR FULL DETAILS OF OUTDOOR UNIT SELECTIONS.

Each system / zone shall be based on one air cooled outdoor unit connected via a single refrigerant circuit, comprising suction and liquid pipe work, to up to 16 indoor units of different models and capacities. Please refer equipment schedule for full details of indoor unit selections.

The Units should be suitable for refrigerant pipe work extended to up to 150 meters between the outdoor unit and the furthest indoor unit on the circuit. The pipe work may incorporate a 50m (40m if the outdoor unit is below) height difference, without the necessity of oil traps.

The vertical separation between the indoor units of any one system can be extended to 15 meters. Where more than 9 indoor units are used then a combination of 4-way and 6-way distribution controllers only shall be used.

OUTDOOR UNITS:

The outdoor unit shall comprise of following facilities:

- Large diameter plastic fan
- DC Fan motor inverter control (preferably all inverter system OR min. one compressor per outdoor unit.)
- Inverter / Constant speed scroll compressor
- Oil level control sensor
- Resin based grille
- Hot-gas defrosting valve
- Pressure sensor

The outdoor units shall be with an operating range from 2HP / 4HP /5HP to 64HP with increments from 2HP/ 4HP/ 5HP.The multi-pipe outdoor unit shall have at least one inverter scroll compressor, which is electronically controlled and capable of changing speed linearly to follow the variations in load. A frequency inverter giving variable capacity control shall control this compressor down to 20% of its capacity.

These units shall also incorporate one fixed speed scroll compressor and one inverter scroll compressor to provide variable load outputs from 20% to 100% of the total capacity of the outdoor unit.

The scroll compressor shall be complete with following features: a reluctance DC motor, optimised scroll design, PWM (Pulse Width Modulation) controlled Inverter Drive, failure back up protection

The outdoor unit shall be suitable for a power supply of 415V + 10% / 3 phase / 50Hz. The outdoor unit shall have a start current and run current as per detailed electrical characteristics recommended by the manufacturer.

The outdoor unit shall be complete with expansion valves, oil separators, crankcase heaters, suction and liquid shut off valves, strainers, liquid receivers and accumulators. The compressor pack shall be mounted on a sliding tray with springs and shock absorbing rubbers to facilitate service and maintenance. The outdoor unit shall be complete with all safety devices including high pressure switch, fuse, thermal protectors for compressor and fan motors, over current protectors for inverter and compressor motors, sequential start and recycling timers, and a common fault indication.

The compressors, refrigerant circuits and electrical box should be placed in and enclosed compressor compartment separated from the air passages.

The outdoor unit shall include a 7-segment light emitting diode (LED), which shall provide a visual display of the current status of the system. This 7-segment display shall be visible from the outside of the unit during normal operation.

The outdoor unit shall be completely weatherproof and be factory assembled, pre wired and complete with all necessary electronic and refrigerant controls for easy installation. The unit shall be selected to enable it to run at low noise level of 50 dB (A).

The outdoor unit shall be factory charged with the necessary refrigerant (CFC Free Refrigerant-R410A). Additional refrigerant charge shall be added, as per the site conditions and as per recommended by the manufacturer, during the commissioning procedure. The outdoor unit heat exchanger shall be 'V' shaped and shall be formed of seamless copper tube with internal grooving, and mechanically bonded to aluminium fins. The outdoor unit heat exchanger shall be full height at the rear of the unit and shall be formed of seamless copper tube with internal grooving, and mechanically bonded to aluminium fins.

The outdoor unit shall be of suitable dimensions to ensure that the unit can be passed through a standard door opening (650mm). This optimized physical dimension shall assist with the movement of the equipment to the agreed outdoor unit location as well as ensuring that the area of steel decking is kept to a minimum.

The outdoor unit fan motor(s) shall be totally enclosed and incorporate a thermal fuse. The outdoor unit fan motor(s) shall have multi speed operation to maintain constant head pressure control in all modes of operation within the ambient parameters.

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

The outdoor fans shall accommodate a short amount of ductwork, where required, in order to expel discharge air when units are sited internally. Where a discharge air duct is used, removable ducting is recommended to

ensure access to the fan section. The fan static should be able to take care of the losses due to duct cowl. The unit casing shall be manufactured from polyester powder coated galvanized sheet steel. The colour finish shall be to the manufacturers' recommendations. Access to the units for routine service and maintenance shall be through the front panel only. For installation purposes only, access to the units shall be via removable panels.

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

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

INDOOR UNITS:

The following models of indoor units shall only be acceptable:

- Hi-Wall Type
- Cassette Type (Mini / Normal)
- Ductable Type
- Package Type

The indoor unit shall be constructed from galvanized sheet metal panels. All surfaces shall be thermally and acoustically insulated. The indoor unit shall include fan impeller with direct drive fan motor. The motor shall be sealed and lubricated for life, the whole assembly being statically and dynamically balanced.

The motor shall be of the totally enclosed, permanent split capacitor type with thermal safety cut out. For Ductable Units the fan static shall be suitable to overcome losses in ducting, accessories, grills and dampers and return air path.

Indoor units, which are located above the ceiling, shall include a condensate lift up mechanism. This lift up mechanism shall raise the condensate to a level of 600mm minimum from the bottom of the unit. The condensate shall then run either to a gravity drain or a subsequent additional condensate pump (in case of units below ceiling level, i.e. cassette & high wall types, the same shall be included). The length and diameter of condensate pipe work from the lift up mechanism shall be kept to a minimum and shall comply with the manufacturer's recommendations.

Indoor units located below ceiling level shall require an additional condensate pump and shall be supplied by the installation contractor. Where required, wall mounted units shall include the standard condensate pump kit as supplied by the manufacturer.

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

fully tested at works. The refrigerant pipe terminations shall be fitted with flared connections, complete with flare nuts.

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

The indoor unit shall be complete with all necessary controls including air and refrigerant temperature sensors and electronic expansion valves thus giving individual, variable refrigerant flow. The electronic expansion valve shall be controlled by the 'fuzzy logic' microprocessor control system via a control board within the indoor unit that includes a unit address recognition system.

The indoor unit shall be provided with its own integral temperature sensor fixed onto or adjacent to the return air grill, measuring the return air temperature. The indoor unit shall be suitable for a power supply of 240V/ 1 phase/ 50Hz OR 415V / 3 phase / 50Hz.

The indoor unit shall incorporate a return air filter. Filters shall be removable via the front, or underside of the unit, without removing any screwed panels. Filters shall be of the washable type unless otherwise specified. The unit shall be selected to enable it to run at low noise level of 35～40dB (A)

CONTROLS:

REMOTE CONTROLLER: Where required individual hard-wired remote controllers shall only be used. Remote controllers shall be capable of controlling individual indoor units or a group of indoor units (up to 16) as supplied by the manufacturer.

Remote controllers shall have a liquid crystal display (LCD) and shall incorporate the following control functions: on/off, fan speed selection, set temperature selection and adjustment, operation mode selection, auto swing selection, filter cleaning identification, full fault diagnostics display, and 24 hour programmable timer.

Remote controllers shall also include the facility of a sensor housed within the casing of the controller which, when activated, will sense and control the room temperature.

The standard control functions of the remote controller shall also include a master/slave setting. Functions on the remote controller shall be inhibited or activated through a series of dip switches and jumper wires on the printed circuit board of the remote controller

GROUP CONTROLLER (ZONE CONTROLLER): Where required, group on/off controllers shall only be used. Group controllers shall incorporate the facility of turning on and off up to 16 groups on any one network (one network being up to 48 indoor units), as supplied by the manufacturer. A group of units shall be defined as either a single indoor unit or a series of up to 16 indoor units. There shall be a maximum of 3 Group controllers per network. The group controller shall provide a visual indication (as well as an electrical signal) for a fault

condition, identifying either an individual indoor unit or series of indoor units (depending on how the indoor units are grouped). Where required, the group on/off controller shall be interfaced with the central controller.

CENTRAL CONTOLLER / MASTER CONTROLLER: Where required a central controller shall be used. The central controller shall be capable of controlling one complete network of indoor units (one network being up to 48 indoor units) as supplied by the manufacturer.

The central controller shall have a liquid crystal display (LCD) and have the capability of controlling units individually, in groups and unanimously. The central controller shall have the unique capability of arranging indoor units into groups (up to 16 groups per network).

The central controller shall have the following control functions of each series of indoor unit arrangements: on/off, fan speed selection, set temperature selection and adjustment, operation mode selection, auto swing selection, filter cleaning identification and full fault diagnostics display. The central controller shall have the capability to override the individual remote controller of any unit on the same network. The central controller shall provide a visual indication (as well as an electrical signal) for a fault condition, identifying either an individual indoor unit or series of indoor units (depending on how the indoor units are grouped).

The central controller shall be time clocked by the 7-day-Year round programmable timer supplied by the manufacturer or by an external time clock (supplied by others). When used in conjunction with the 7-day programmable timer then different programme on/off times for each group of indoor units shall be available.

7-DAY PROGRAMMABLE TIME CLOCK: Where required, the 7-day programmable timer shall be used. The 7-day programmable timer shall operate a time clock function for all the indoor units on each network. It shall be capable of controlling all the indoor units unanimously or up to 16 groups of indoor units when used with the central controller.

The 7-day programmable timer, as supplied by the manufacturer, shall have a liquid crystal display (LCD) and be capable of 3 separate cycle times each day for each group. Programmed times can be different for each day (a true 7-day timer) with the option for day omit as well as the program advance.

The 7-day programmable timer shall be capable of one-minute timings and have a memory back up which restores program times after power interruption.

Indoor Units to trip in case of fire signal.

SEQUENCIAL CONTROL:

The particular set of indoor units shall be controlled in sequence when working on N+1 basis. Controller for sequencing, programming scheduling the Indoor Units for critical rooms for equal run, auto stand-by change over, fault take off etc. as specified. The controller shall be enclosed in an IP-54 Panel. Separate Panel shall be provided for each critical room VRF indoor unit set. Sequential controller shall be provided per set of indoor units for working and standby being provided for a particular area.

CONTROL WIRING: Control wiring shall consist of a 2-core, non-polar, screened cable, specification: RS/823/128. The control wiring shall be installed separate to the mains power wiring and linked to each successive unit as detailed on the manufacturer's system schematic drawing.

In general the control wiring shall be installed to ensure that all units on any one network are connected together. The wiring shall follow the most appropriate route to ensure this common linking of units. The wiring shall not at any time follow a route that would 'close loop' the 2-core screened cable. The following controllers shall be connected at any point along the 2-core control wiring: group on/off, central controller & 7-day programmable timer. Each of these items shall require a 240V /24 V power source and shall include the necessary transformer unit. Remote controller wiring only shall consist of a 3-core, polar, screened cable, specification: RS/361/383/485. The remote control wiring shall be installed separate to any mains power wiring.

Remote controllers shall be connected using the 3-core wiring system.

The VRF system and Controller shall be able to trip in case of fire signal.

PIPE WORK:

Pipe work shall be sized according to manufacturer's recommendations in the Engineering Data Manual. Pipe work routes should always be planned to ensure the shortest route. The following restrictions in pipe work length shall be adhered to:

- Up to 100 m between outdoor and indoor units.
- 30 m height (max) difference between indoor units, and 50 m between outdoor and indoor units.
- 4 m maximum lift between outdoor units and 20m total separation between them.
- 250 m total system piping network, and up to 70 m between outdoor unit and first Y-joint/header (actual length)

All pipe work shall be insulated with slip on, Closed Cell Foam / EPDM /Close Cell Elastomeric pipe insulation with a fire performance to ASTM E 84 / Class 'O' of the current Building Regulations. All pipe work insulation shall have a minimum wall thickness of 19 mm EPDM /Closed Cell Insulation and shall be supplied & installed by the specialist installer.

Insulation shall have all joints suitably bonded and shall be protected, when exposed to atmosphere, by special paint or covered by an enclosure.

Longest possible lengths of copper pipe shall be utilized to minimize joints on site. The appropriate refrigeration tools must be utilized to avoid the use of brazed fittings such as elbows.

Branch pipes and branch pipe kits supplied or recommended by the manufacturer shall only be used. These branch pipes shall be installed in accordance with the manufacturer's instructions, allowing unrestricted flow of refrigerant. The use of reducing tees shall not be permitted, as an equal pressure drop at the branch connection is essential.

All brazed joints shall be made with dry nitrogen purge to ensure the prevention of oxidization to the internal surface of the copper pipes. The ingress of moisture, dirt and any other contaminants to the interior of the copper pipes, and air conditioning units, shall be prevented during the installation procedure.

After installation of pipe work and prior to the connection of the outdoor units, sealing of insulation joints and starting the outdoor unit, the pipe work shall be pressure tested. The pipe work shall be charged with dry nitrogen to a pressure of 400psi and shall be held for 24 hours (minimum) in order to check for leaks. When the pressure has not dropped over the 24 hours, the outdoor units shall then be connected.

- All brazing to be completed with flowing OFN
- 3-stage pressure test up to 38 bar/550 psi
- Same vacuum requirement as existing system
- Charge in liquid phase

The complete system shall then be evacuated to vacuum of 3 Torr and held at that setting for 1 hour (minimum) to 4 hours depending on the length of pipe work. Any increase in the Torr gauge shall represent moisture in the system and it shall be re-evacuated and held for 1 hour (minimum) again.

Only when the above has been completed shall the additional refrigerant be added (as per manufacturer's guidelines for additional refrigerant volume required) and the electrical connections made to the indoor and outdoor units.

COMPATIBILITY WITH BMS:

The advanced Building Management System (BMS) should be user-friendly software with a Windows based platform, permitting management of up to 1024 units with the possibility to control the entire system through a Local Area Network (LAN) or remote monitoring via the Internet.

Interactive control alerts the user or the service engineer about system failures through e-mail messages, alphanumeric beepers and fax should be included.

Energy monitoring to meter the system's power consumption per individual indoor unit is also possible.

The Variable Refrigerant Flow (VRF) System should be with Open Protocol and fully compatible with the current suite of advanced air conditioning monitoring and control systems including the 'Intelligent Controller", "Intelligent Manager", "BAC net Gateway" and "LON works" or any other BMS Protocol.

SCOPE:

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

Inline Ductable Fans – For Fresh air supply, Projection, Toilet exhaust, Elec. Panel RM exhaust, etc.
Smoke Extract Fans (Tube axial Type)

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

SUBMITTALS:

Following submittals are required for approval:

Shop drawings on each piece of equipment specified in accordance with the technical specifications.
Fan curves and selection sheet
Data Sheet duly filled
Fan point load diagram (Incase of centrifugal pumps)
Foundation details (Incase of centrifugal pumps)
3 Sets of Installation, Operations and Maintenance Data (IOM) Manual

IN-LINE DUCTABLE FANS: (For drawing fresh air from outside, toilet exhaust, elec. panel room exhaust and Projector exhaust.)

RECTANGULAR INLINE FAN:

This low noise fans shall be with flanges provided on both sides of the inline fan to facilitate easy connection. Flexible anti-vibration joints shall be provided to arrest vibration being communicated to other equipment connected to the inline fan. Motor shall be single/three phase as per duty conditions required. Capacities and total static pressures should be as per Fan Summary Sheet and as mentioned in schedule of quantities.

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

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

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

CIRCULAR INLINE FAN:

This low noise fans construction should be such that it is possible to install the assembly in any position. The fan motor should be suitable for single-phase electric supply. The motor shall be complete with motor protection through built-in thermal contact and TEFC (IP-54) enclosure. The motor construction shall be such that it is possible to regulate the speed from 100%-10%. The fan assembly shall be reliable and suitable for continuous operation. The fans shall be complete with all accessories as required. Flexible anti-vibration joints shall be provided to arrest vibration being communicated to other equipment connected to the inline fan.

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

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

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

IN-LINE CENTRIFUGAL DUCT FAN:

Fan shall be of SISW, forward or backward curved centrifugal, direct driven type. Casing shall be of Galvanized steel with Oven-baked epoxy coating. Impeller material shall be either Galvanized Steel or Glass Reinforced Polypropylene. Motor shall be external rotor type for power supply 220~240V/50Hz/Single Phase.

AXIAL FLOW FANS (DIRECT DRIVE/ BELT DRIVE):

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

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

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

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

Running clearance between blade tips and casing shall not exceed 1% of the impeller diameter and 2% for smoke spill high temperature fan where mechanical expansion coefficient is different from normal ambient temperature.
Fan manufacturer shall provide the fan assembled with the dame clearance between blade tips and casing of the tested prototype. Note that the air performance and pressure loss are greatly affected by this clearance.

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

Fan motor shall be totally enclosed and external terminal box of at least IP55 shall be provided. Fans shall not exceed 1450 RPM.

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

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

ROOF EXHAUST FAN (DIRECT DRIVEN):

Fan casing shall be fixed onto the support square base by means of bolts and nuts and properly sealed against air leakage and entry of rainwater. Fan housing and support square base shall be constructed of electro galvanized or cold roll steel sheet, oven-baked polyester coating or hot dipped galvanized. Weather cowl shall be molded to cover and overlap the entire fan casing in flame retardant glass fiber reinforced resin.

Support square base and weather cowl overlapping should be designed to ensure smooth flow of the air entry and discharge as tested prototype, otherwise additional pressure loss to the system resistance is required.

Fans shall be suitable for flat or/and pitched roof installation. For fans for smoke extractor purpose, the motor and fan assembly shall be capable of withstanding for 250C for 120 minutes or 300C for 30 minutes.

Centrifugal Roof Smoke Extractor Fans shall be backward curved impeller with vertical air discharge type. Support casing and mounting base shall be in galvanized steel with protection grille / bird net. Weather cowl and weathering skirt shall be molded in flame retardant glass fiber reinforced resin.

CABINET FANS:

Fan contained within cabinet shall be licensed to bear the AMCA Air and Sound Certified Rating Seal. Fan shall be of DIDW Forward or Backward curved with fan scroll, belt drive or direct drive assembled within a cabinet. Cabinet shall be constructed of Galvanized Steel material. Cabinet shall be of "Panel Construction", assembled together by means of fasteners for easy of dismantling for service and maintenance. Welded cabinets are not acceptable. Cabinet design shall be capable of adding acoustic insulation (i.e. double skin arrangement) if requested for noise reduction.

DIRECT DRIVE TYPE:

Fans shall be of DIDW Forward Curved centrifugal type with fan scroll within a cabinet. Fan speed shall not exceed 1450 RPM. Motor shall be for power supply 220~240V/50Hz/Single Phase.

SMOKE EXTRACT FANS: AXIAL FLOW FANS: (For smoke extract)

The fans shall be Kruger / Nicotra / System Air make direct-drive, multiple blade type mounted on a steel mounting plate with orifice ring.

Casing should be double flanged in M.S. / Galvanized steel sheet with fixing flanges and protected against atmospheric agents by epoxy paint. Fan shall incorporate high efficiency axial impeller with manually adjustable pitch blades of pressure-cast Aluminum. Airflow shall be from impeller to motor.

In case of corrosive/inflammable air, the motor shall be isolated from air passage.

For exhaust of Smoke/Inflammable air, fans shall be of 2 hrs fire rating for 250OC. Motor shall be of special construction and high temperature resistance Class 'H', compliance to BS7346 Part2 1990, Class B performance. Motors upto 2.2KW to be with DOL starting and motors above 3.0KW to be with star/delta starting. Fan outlet velocity should not exceed 11 m/s.

Motor should be selected to handle air at ambient temperature based on specific air volume and static pressure.

High temperature special flexible connections should be used to duct connections to the fan.

Accessories:

The following accessories shall be provided with all fans:
Extension with inspection door
Inlet cone, Flat and conic protection grid
Fixing brackets
Protection guard
Collars for duct fixing

Back draft shutter.

PERFORMANCE DATA:

All fans shall be selected for the lowest operating noise level. Capacity rating, power consumption with operating points clearly indicated, shall be submitted, and verified at the time of testing and commissioning of the installation. Noise level at 1 meter from the Fan shall be less than 60 dBA.

TESTING:

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

Test Certificates for Smoke Extract Fans shall be submitted with the fan supply to confirm the requisite performance.

VARIABLE FREQUENCY DRIVES (for AHU):

GENERAL:
A HVAC dedicated variable frequency drive is preferred over standard drives. The VSD shall meet LEED Requirement Criteria Core Performance Section 3.10 Variable Speed Control.

The manufacturer shall have its own sales and service support network throughout the country. They shall provide full technical support, spares holding and troubleshooting capability from their own facility. A training course shall be provided by the manufacturer to the operating and maintenance engineers. The supplier shall provide complete technical details of the product with the offer including catalogues, operating manual, dimensional drawings, weights etc.

VFDs shall conform to the recognized international standards like IEC and manufactured according to ISO 9001, BS 5750 part 1 & 2 and shall be UL listed. It shall carry the CE mark on EMC compliance.

EMC & Harmonic Filters shall be provided as necessary for compliance to IEEE 519. Proper care to be taken to avoid EMI.

Suppliers shall offer a single series of controller over the whole required power range to ensure a common user interface, common circuit requirements and common spare parts.

VFDs shall be suitable for operation in a "Stand Alone" mode, complete with all necessary protection to the motor or as a part of the centrally controlled Building Management System (BMS).

for AHUs - Temperature sensor (Thermostat shall be placed in RA path/ duct - 1no). The VFD shall be capable to take inputs from Temperature sensor and operate the VFD based on reading available.

VFD DESIGN REQUIREMENTS:
The VFD shall be of the type suitable for operation on a 3 phase, 415 V, 50 Hz input power supply.

The VFD shall be suitable for operation at full load at the following conditions:
Input supply voltage variations : + 10 %

Input supply frequency variations	:	+ 2 %
Ambient temperature	:	0 - 40oC
Maximum relative humidity	:	95% non condensing
Minimum efficiency at full load	:	96%

The VFD shall use the advanced digital Vector Control technology for converting fixed voltage and frequency to variable voltage and frequency. It should ensure that full motor power is utilised at the rated speed.

The VFD shall automatically correct the output voltage during main's variations of + □10% to prevent loss of torque and speed variations occurring during motor operation.

The VFDs shall have a metallic enclosure with a protection of minimum IP 20 and shall be suitable for installing inside a IP 54 control panel with out any derating.

The output waveform of the VFD shall be suitable to control the quadratic load torques produced by pumps and fans to ensure that maximum total efficiency is obtained from the motor and drive at all loads and speeds. The VFD shall be capable of automatically varying the V/f ratio based on the load variations. VFDs providing constant or selectable V/f ratio are not acceptable.

The VFD shall be capable of providing minimum 160% torque for 0.5 sec and 110% torque for 1 min. at starting.

The VFD shall work in conjunction with any IEC standard design motor and shall not require the motor to be derated or cause the motor temperature to rise above the normal class 'B' rise expected on normal mains operation. The motor shall not require an external blower even at slow speed running.

The VFD shall protection against damage of motor bearings due to the high voltage spikes by providing soft switching of the IGBTs. Those VFDs without soft switching shall be provided with LC filters (motor chokes) of suitable ratings.

The VFD shall incorporate an "Automatic Energy Optimiser" function which continually adjusts the output voltage to a reduced level to give maximum motor efficiency at any given partial load.

The VFD shall automatically adjust the output frequency and voltage to maintain a stable motor speed of +/- 0.5% at the motor's rated speed. This accuracy shall be maintained over a speed range of 1% to 100% without the use of a closed feedback loop.

The VFD shall allow selection of motors one frame size larger and 4 sizes smaller than its nominal rating.
The VFDs shall be immune to interference from other RFI producing equipment and shall comply to AS/NZS 4252.1 – 1994, EN 61000-4-2, EN 61000–4-3, EN 61000-4-4, EN 61000-4-5, ENV 50204, ENV 61000-4-6 and VDE 0160.

The VFD shall contain as a standard built-in DC reactors with both inductive and capacitive elements to control the mains harmonics. The harmonic current distortion produced by the controllers shall comply with IEC 1000-3-2 and IEC 100-3-4 respectively according to the current ratings.

VFDs that do not include built-in DC reactors for harmonic control shall be supplied with external 3-phase AC reactors on the mains side with a minimum impedance of 3%. These AC reactors shall be of the same make of the VFD and shall be supplied as an integral part of the VFD by the manufacturer itself.

The VFDs shall be capable of allowing for a minimum of 1 start/min. on mains operation. Start/stop operation using electronic operation shall be unlimited.

The VFDs shall be suitably protected to allow for switching to take place on the output via a contactor or isolator without damage to the inverter transistors or the switching device.

The controller shall include features which limit the rate of the output voltage rise over time (dV/dt), and prevent peak voltages from occurring. Those VFDs having a higher dV/dt than specified shall be supplied with integral LC filters by the manufacturer itself.

The switching frequency of the VFD shall be adjustable to reduce the acoustic noise generated from the motor. While adjusting the switching frequency no derating shall be applicable to the VFD.

The VFD shall be capable of allowing up to 150 meters of armoured cabling between the VFD and the motor. If the offered VFD cannot allow this cable length, the supplier shall include motor chokes (LC filters) of coil reactance value required to increase the cable length upto 150 meters and quote accordingly.

The VFD shall incorporate automatic motor tuning function to adapt itself to the actual motor parameters. The tuning shall be based on measurements of the motors inductance and resistance.

The VFD shall be capable of automatically reconnecting to a spinning fan, forward or reverse running without tripping following mains interruption or transfer from bypass running.

The VFD shall have DC injection braking to ensure that a pre-rotating high inertia load motor, even in the reverse direction, can be switched onto, braked to zero and then accelerated to the preset speed in the correct direction.

The VFD shall be provided with at least 4 by-pass frequencies with adjustable band width in order to eliminate resonance in duct work and pipe lines occurring within the motor's operating frequency range.

The VFD shall incorporate an in-built programmable PID controller to enable closed loop control of the process. It shall respect the minimum and maximum limits and shall include an anti wind-up function. The PID controller shall be able to operate in the normal or inverse modes. Remote monitoring of the feed back signal via a 0/4 - 20mA signal from the VFD is required.

The VFD should include an interlock function which allows control and interlocking of other mechanical equipment such as dampers.

In case of a power failure, the VFD shall be capable of automatically restarting after a programmable time delay.

CONTROL AND MONITORING FUNCTIONS:

Full galvanic isolation between power and control components shall be incorporated to ensure compliance with VDE 0160 PELV (Protective Extra Low Voltage) to prevent damage to BMS interface and ensure operator safety. Short circuiting of the control terminals shall not damage the control card. VFDs without galvanic isolation shall be provided with opto isolators.

At least 6 digital inputs shall be provided with freely programmable functions and shall have a scan time less than 3ms.

2 analog inputs accepting voltage (max 10V) and current (max 20mA) inputs shall be provided in the VFD. These inputs shall be freely programmable and scalable.

Two programmable relays shall be provided for remote monitoring of the VFD. The programmable options shall include as a minimum ready, run, and alarm. The run relay function shall initiate a run signal only when the frequency output from the VFD is greater than 0.5 Hz.

Two programmable analogue outputs (for providing current and speed feedback to BMS) of 0/4-20 mA shall be provided for monitoring. The programmable options shall include as a minimum speed, current and torque.

The VFD shall be capable of accepting input from a thermistor.

The VFD shall be able to accept a pulse train the frequency of which gives an analogue reference of feedback.

The VFD shall have an internal power supply to provide a sensor supply for the digital inputs and any loop powered analogue sensors. This internal power supply shall have a minimum capacity of 100 mA at 24V DC.

The VFD shall be able to generate a pulse train output, the frequency of which is proportional to the signal being transmitted.

The VFD shall have local control panel with multi-line selectable alpha-numeric display which shall display the following minimum information:

Frequency in Hz
Feedback signal in units
Current in A
Output Voltage in V
Power in kW
Energy in kWh
Output voltage V
Run time in hours

Those VFDs with LED display as standard are not acceptable and shall be supplied with additional alphanumeric displays. The local control panel shall be used for setting parameters and tuning the VFD.

The VFD shall display the following minimum faults in clear English text and not by codes.

Mains phase loss
Over voltage
Under voltage
Inverter Overload
Motor Thermal Overload
Over current
Earth fault
Switchmode power Supply fault
Output short circuit
RS485 communications timeout
Heat sink over temperature
Motor phase missing
Inverter fault

The VFD shall provide for Hand /Off /Auto switch to allow for local control by hand or remote Auto control by the BMS. This function shall be selectable via the Local Control Panel or via digital I/O.
The VFD shall log and display "Total kWh consumed" and Total Hours Run" by the motor without additional instrumentation and facility to reset.

The VFD shall be fitted with a RS485 serial port with an open protocol for allowing serial communication with the BMS system.

The following indicating lights shall be provided on the local display panel of the VFD:
VFD 'ON' b) VFD 'WARNING' c) VFD 'ALARM'

A parameter lock shall be available in the VFD local display panel to prevent unauthorized resetting of parameters.
PROTECTION FEATURES:

The VFD shall shut down safely under the following conditions, and operate the alarm relay. The display shall indicate the nature of the fault in clear English text.

- Mains phase loss
- Over voltage
- Under voltage

Inverter Overload
Motor Thermal Overload
Over current
Earth fault
Switch mode power supply fault
Output short circuit
RS485 communications timeout
Heat sink over temperature
Motor phase missing
Inverter fault

The VFD shall provide for both automatic and manual reset operation. In automatic mode there shall be a programmable choice of up to 10 reset attempts per fault before the controller shuts down making manual reset necessary to restart the system. The restart time after a trip in automatic mode shall be adjustable. In manual reset mode the reset shall be accomplished from both the keypad on the controller and by remote signal.

The VFD shall be equipped with a data log menu that will allow storage of at least 10 latest faults that have occurred. Last fault memory shall be required in the event of power failures.

The VFD shall have a sufficiently fast current limit feature to survive a continuous short circuit on the output terminals without damage to any drive components.

The VFD shall not require special type input protection devices such as high speed semi-conductor fuses. In case, these are necessary for protection of the VFD, the same shall be included in the scope of supply of the VFD supplier.

The VFD shall maintain operation as long as possible under fault conditions. For example the controller should automatically derate itself and reduce the speed to a safe level on high temperature or a phase loss to maintain some control of the process rather than shutting down due to a trip.

The controller shall include electronic motor thermal overload protection where the trip time is based on the motor's running frequency, actual motor current, operating time and the motors rated current. The device shall automatically modify the trip time to take into account operation at low speed. On trip the controller shall indicate that the fault is a motor thermal trip.

No rear access shall be necessary during normal service function.

BMS requirements shall be in compliance with the requirement and scope sheet as attached at the end of Technical Specifications.
EMI & Harmonic Filters shall be provided as necessary for compliance to IEEE 519. Proper care to be taken to avoid EMI.

AIR DISTRIBUTION SYSTEM:

GENERAL:

Supply, fabrication, installation and testing of all sheet metal ducts & supply, installation, testing, adjusting and balancing of all grilles, registers and diffusers, in accordance with these specifications and the general arrangement shown on the drawings. Galvanized steel sheets shall be SAIL-BHILAI make.

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

All ducts shall be fabricated from galvanised steel sheets of the following thickness as indicated in Bill of Quantities & as described in the IS: 655 with latest edition.

RECTANGULAR DUCT:

Dimensions of Ducts (mm)	Gauge G.I.	Gauge Al.	Type of Joints	Type of Bracings
Upto 600	24	22	G.I.Flange at 2.5 Centre	Cross Bracings
601 to 750	24	22	25 x 25 x 3mm angle iron frame with 6mm dia. nuts and bolts.	25 x 25 x 3mm MS angles bracing at 1500mm from joints.
750 to 1000	22	20	25 x 25 x 3mm angle iron frame with 6mm dia. nuts and bolts.	25 x 25 x 3mm MS angles bracing at 1500mm from joints.
1001 to 1500	22	18	40 x 40 x 5mm angle iron frame with 8mm dia. nuts and bolts.	40 x 40 x 3mm MS angles bracing at 1500mm from joints.
1501 to 2250	20	16	50 x 50 x 3mm angle iron to be cross braced diagonally with 10 mm dia nuts and bolts at 125 centre.	40 x 40 x 3mm MS angles bracing at 1200 mm from joints OR 40 x 40 x 3mm MS angle diagonal bracing.
2250 and above	18	14	50 x 50 x 6mm angle iron to be cross braced diagonally with 10mm dia nuts and bolts at 125 centre.	50 x 50 x 3mm MS angles bracing at 1200mm from joints OR 50 x 50 x 3mm MS angle diagonal bracing.
Fire Rated Ducts & Grills for Smoke Exhaust				
All Sizes	18 (1.2mm)		50 x 50 x 3mm MS angles flanges / bracing at 1200mm from joints OR 50 x 50 x 3mm MS angle diagonal bracing.	

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

HANGERS FOR DUCT:

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

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

FABRICATION:

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

a) Ducts so identified on the drawings shall be acoustically lined with thermal insulation as described in the section `Insulation' and as indicated in schedule of quantities. Duct dimensions shown on drawings are overall sheet metal dimensions inclusive of the acoustic lining, where required and indicated in schedule of quantities.

b) Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight.

c) All exposed ducts within conditioned spaces shall have flanged joints. Exposed ducts, where required or as indicated in Schedule of quantities, shall be painted with two coats, of enamel paint of approved colour. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.

d) Changes in dimensions and shape of ducts shall be gradual. Curved elbows, unless otherwise indicated, shall have a center line radius equal to one and a half times the width of the duct. Air turns shall be installed in all vanes, arranged to permit the air to make the turn without appreciable turbulence. Suitable vanes shall be provided in duct collar to have uniform/ proper air distribution.

e) Ducts shall be fabricated as per details shown on drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles of sample size to keep the ducts true to shape and to prevent bulking, vibration or breathing.

f) All sheet metal connections, partitions and plenums required to confine the flow of air to and through 18g GI/16 gauge aluminium, thoroughly stiffened with 25mm x 25mm x 3mm galvanized iron braces & fitted with all necessary doors as required to give access to all parts of the apparatus. Access Doors shall be not less than 45cm x 45cm in size.

FACTORY FABRICATED DUCTS & FITTINGS:

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

Incase of necessity, samples of sheet selected at random by Client representative shall be tested for thickness & zinc coating at supplier / contractor's expense.

The duct work construction, erection, testing & performance shall be confirming to IS -655 / SMACNA / DW 144 as applicable – but with sheet thickness for various sizes shall be as described above. 26 G ducting is not allowed unless specifically mentioned.

The factory fabricated ducts can be in full wrap around / L shape duct in standard 4' (1200 mm) length with stiffening beads (every 300 mm) duly sealed on seams & joints & with bracing angles omitted. Ducts larger than 600 mm shall be cross broken. In case of duct lengths increasing beyond 1200 mm, bracing may be required.

Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling and mark sections for re-assembly and coordinated installation.

Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts true-to-shape, and to prevent buckling.

Transform duct sizes gradually, not exceeding 20 deg. divergence and 30 deg. convergence.

All the duct work including straight sections, tapers, elbows, branches, transition pieces, shoe-pieces, collars, droppers, terminal boxes, grill / slot diffuser plenums & transformation pieces shall be factory fabricated with state of art equipment such as de-coiler, Plasma / CNC profile cutters, lock-formers & rollers. Plenums shall be factory fabricated panel type & assembled at site.

Four bolt Rolamate / TDC flange / rolled on TDF flange are acceptable for flanged duct joints. Slips on flanges are not allowed. The flanges shall have a groove arrangement for fixing of gasket. All the transverse duct connectors (flanges / cleats), accessories & related hardware such as support system shall be zinc coated (i.e. galvanised) The Rolamate / TDC flange / rolled on TDF flange system is acceptable upto 1500 mm wide ducts beyond which it is required to have galvanised angle flanges (or tie rod arrangement at 1200 mm distance.)

Ductwork supporting arrangement shall be as per IS-655 as described above in site fabricated ducts. Strap supporting system not allowed for rigid GS ducts.

The ductwork shall be fabricated as per approved drawings & all connecting sections shall be dimensionally matched to avoid any gaps. Dimensional tolerance is + 1.0mm of specified dimension. To obtain perpendicularity, the diagonal tolerance shall also be + 1.0 mm per meter.

Longitudinal seams shall be made airtight and the corners shall be Pittsburgh or snap button punch to ensure air tightness.

Each duct pieces shall be identified by coded label / sticker, which shall indicate specific part no., job name, drawing no, duct size & gauge.

The gauges, joints & bracing for the duct work shall confirm to the provisions as indicated on the approved drawings.
Shop fabricated ductwork shall be in 1200 mm / 1500 mm / 2400 mm lengths, unless otherwise indicated or required to complete runs. Pre-assemble the duct work in shop to a greatest extent, so as to minimize field assembly of systems. Disassemble systems only to the extent necessary for shipping and handling and mark sections for re-assembly and coordinated installation.

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

INSTALLATION:

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

i. The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent, of these specifications and drawings. The work shall meet with the approval of Owner's site representative in all its parts and details.

ii. All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and/or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained, all as per the site requirements.

iii. If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points by any path available, in accordance with other services and as per approval of Owners site representatives.

iv. All duct work shall be independently supported from building structure. All horizontal ducts shall be rigidly and securely supported, in approved manner with trapeze hangers formed of GI rods and galvanized angle iron under ducts at not greater than 2-meter centers. All vertical ductwork shall be supported by structural members at each floor. Air conditioning contractor shall supply and install 50mm cube MS boxes with 10mm dia steel rod passing through box, all given two coats of red oxide paint, the MS rod tied with reinforcement bar at point of suspension shall be neatly exposed.

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

v. Ducting over furred ceiling shall be supported from the slab above, or from beams, after obtaining approval of Owner's site representative. In no case shall any duct by supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractors on the building.

vi. Where metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitted heavy flanged collars. Where ducts pass through brick or masonry opening and wooden frame work shall be provided within the opening and crossing ducts provided with heavy flanged collars on each side of wooden frame work, so that duct crossing is made leak-proof.

All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibrations in the ducts, ducts shall be provided of closely woven, rubber impregnated double layer asbestos/canvas or neoprene coated fibre glass fire resistant flexible connection. The flexible connections located close to the unit, in mutually perpendicular directions. The flexible sleeve at least 10cm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

Air conditioning unit and exhaust fans shall be connected to duct work by inserting at air inlet & air outlet a double canvass sleeve. Each sleeve shall minimum 150 mm securely bolted to duct and the connecting duct work rigidly held in line with unit inlet or outlet.

Necessary wall/slab openings making and redoing for erection of equipment, ducts and piping to be in HVAC Contractors scope whether specifically excluded/not mentioned elsewhere.

Ducts shall have neoprene rubber gasket in between at each flange joints.

Smoke Extract Ducts shall have fire retardant gasket at each flange joints.

7.0 SPLITTERS AND DAMPERS:

All dampers shall be opposed blade type dampers of robust construction and tight fitting. They shall be made of G.S. sheet minimum 16 g thick and shall have brass bushes. The design, method of handling, and control shall be suitable for the location and service required.

Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation control or setting devices shall be made robust, easily operatable and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times. Handles will be provided with extended arms to account for insulation thickness.

Dampers shall be placed in ducts and 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 system.

8.0 MOTORISED FIRE & SMOKE DAMPERS (FSD):

All supply and return air ducts shall be provided with 'Caryaire' make fire & smoke dampers at AHU room's wall/floor/ceiling crossing. Fire dampers shall be fusible link / motor operated with at least 90 min. fire and smoke rating as per UL 555S-Class II as tested by CBRI, Roorkee, India.

Fire dampers shall be multileaf type, low leakage type. The blades and outer frame shall be made of 16G galvanised steel sheet. Fire damper assembly shall be factory fitted in a sleeve made of 18G GS sheet of min. 400 mm long. The blades shall be pivoted on both sides using chrome-plated spindles in self-lubricated bronze bushes. Metallic compression seal shall be provided on both ends to prevent smoke leakage. Stop seals shall be provided on top and bottom. Dual side linkage shall be provided for better structural stability. The construction of fire damper shall allow maximum free area to reduce pressure drop and noise in air passage.

Every damper shall be factory tested and should be certified by the manufacturer inform of the test certificate.

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

Access doors shall be provided at each side of the FSD.

ACTUATORS:

The actuator used shall be maintenance free direct coupled spring return type suitable to work on 24V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/close the damper. The selection of actuator size shall be the responsibility of the FSD manufacturer.

Spring return time shall be 20 seconds or less at ambient temperature. Other features shall include:

It shall have tamper proof housing with IP-54 protection rating.
Shall have mechanical integrity of atleast one hour at 900oC.
Shall have minimum 60000 safe position at rated torque. It shall be capable to withstand temperature of 75oC for 24 hrs.
Shall have electronic over load / digital sensing circuit to prevent damage to the actuator.
Should be capable of changing direction of rotation by changing mounting orientation.
Shall have manual over ride facility.

CONTROL PANEL:

The control panel shall be supplied by the damper manufacturer and fitted on the damper compatible with damper actuators. The control panel shall have at least following features:
Power ON indicating lamps with 230V /24V transformer.
Damper close and open indication.
Reset push button.
Push button for manual running of actuator for periodic inspection.
Auxillary contacts 24V & 230V.
Contact points to receive signal from smoke detector /fire alarm panel.

SUPPLY AND RETURN AIR GRILLES:

Supply and return air grilles shall be Air products make extruded aluminium powder coated construction. Client will approve the color shade for all grills.

The grills and registers shall be as per specified in the schedule of quantities (BOQ).

SUPPLY AND RETURN AIR DIFFUSERS/ DISTRIBUTORS:

Supply and return air diffusers shall be Air products make shown on the drawings and as specified in schedule of quantities (BOQ). The supply air diffuser shall be provided with removable key operative volume control dampers as specified in BOQ. All Aluminium supply and return air diffusers shall be powder coated and to have colour of client's choice or shall be extruded aluminium.

i. Square Diffusers:

Supply/return air linear diffuser shall be extruded aluminium construction, square, rectangular, or round diffusers with flush fixed pattern or adjustable flow pattern. Diffusers for different spaces shall be selected in consultation with the Consultants. Supply air diffusers may be equipped with fixed air-distribution grids, removable key-operated volume control dampers, and antismudge rings as per requirements of schedule of quantities. These shall be as specified in the BOQ.

The material thickness of grills, diffuser, damper shall be as follows:

Diffuser		Aluminium	
a)	Frame		18 gauge
b)	Louvers		18 gauge
	Grills:		
a)	Frame		18 gauge
b)	Louvers		24 gauge
V.C. Damper:			
a)	Frame		18 gauge
b)	Louver		24 gauge

ii. Fresh air intake and Extract louvers:

All the louvers shall be rain protection type and shall be fabricated from extruded aluminium section. The louvers shall additionally be provided with heavy duty expanded metal (aluminium - alloy) bird screen. Outside/exhaust air grills shall be George Rao /Caryaire make with wall fixing accessories and baffles for theatres of approved colour along with wall fixing accessories for remaining areas.

JET DIFFUSERS:

The Aluminum Jet Diffuser / Louver should be manufactured from heavy -gauge aluminum. The multi-directional louver body and all other components are should be machined to close tolerances from solid aluminum alloys, then bright polished. The flange-to-body gasket consists of two tandem felt strips for a leak proof seal. These components comprise a unit, which provides smooth movement of the louver body when adjusting its direction.

A knurled aluminum thumb operated airflow adjustment knob facilitates control of airflow by regulating the volume out of the exit nozzle with the precision internal damper. The internal damper is under tension by a stainless steel leaf spring for leak-proof sealing and quiet operation.

The louver shall be of heavy-duty construction of all aluminum alloy materials, and shall not be welded, fastened or riveted. The device shall have a precision airflow adjustment to modulate exiting airflow from any position between.

TESTING & BALANCING:

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks before painting the interiors of conditioned spaces air distribution system shall be allowed to run continuously for 48 hours for driving away any dust or foreign material logged within ducts during installation.

THERMAL/ACOUSTIC INSULATION OF DUCTS/WALLS:

GENERAL:

Scope of this specification comprises of supplying, installing, testing and commissioning of insulation on ducts, accoustic lining of ducts and AHU rooms.

DUCT INSULATION:

Ducts shall be provided with fiberglass insulation with factory backed Aluminium foil of specified thickness.

1.1 Thickness of Insulation:

a. Duct passing through return air areas = 25mm

b. Duct passing through non air conditioned space = 50mm

c. Duct passing through ventilated attic space = 50mm

d. Duct exposed to weather = 50mm + cladding/plant

1.2 Application: (For unexposed duct)

Clean the surface of duct and apply coat of cold setting CPRX adhesive/Hot bitumen of approved make applied @ 6 Sq.M/Kg.

Fix the insulation material of required thickness before adhesive dries up. All joints shall be provided with covering of 75 mm wide insulation strip to seal all transverse & longitudinal joints.

Where the duct is exposed to atmosphere material shall be same as for ducts not exposed to atmosphere and provided with factory laminated tamperproof aluminium lamination or exterior grade K-Flex paint for protection from ultra violet rays and other injuries.

2.0 ACOUSTIC LINING/ INSULATION OF AHU ROOM AND ACOUSTIC LINING DUCTS:

For acoustic lining of AHU room material shall be resin bonded glass wool 50 mm thick of density not less than 32 kg/m3. For Cinema Theatres all ducts upto a distance of 5m from AHU outlet or as shown in the drawing shall be acoustically lined from inside with 25mm thick / 48 Kg/m3 density. For other areas the ducts upto a distance of 5m from AHU outlet or as shown in the drawing shall be acoustically lined from inside with 12mm thick/ 48 Kg/m3 density.

2.1 Application:

2.1.1 Wall Lining/Insulation:

Specification for acoustic lining of air handling unit room walls/ceiling:

For acoustic lining of AHU room insulating material shall be resin bonded glass wool of density 32kg/m3 and thickness 50mm.

Clean wall/ceiling surface which is to be acoustically lined.

Fix GI frame U sections of size 25 x 45 x 25 mm or of equal insulation thickness as specified, in 600 x 600 grid to the wall/ceiling with rowl plugs & GI screws.

Apply 2 coats of CPRX adhesive on wall/ceiling.

Resin bonded glass wool of 50mm thickness shall be fixed in GI frame of 600mm x 600mm dimension, covered with R.P. Tissue.

Cover the material with 24 gauge perforated aluminium sheet having 3mm dia perforation of 30% area with GI screws and cup washers.

All joints of perforated aluminium sheet should be covered with 20 mm wide & 4 mm thick aluminium curved beading.

2.2 Duct Lining:

Clean duct surface area, Fix GI frame U section of size 25 x 25 x 25 mm with GI rivets.
Apply two coats of CPRX adhesive /hot bitumen on ducts.

Resin bonded glass wool of 25mm thickness shall be fixed in GI frame covered with R.P. tissue.

Cover the material with 24 gauge perforated aluminium sheet having 3mm dia perforation of 30% area with GI screws and cup washers.

SOUND ATTENUATING UNITS:

The duct sound attenuators shall be factory fabricated with the sheet metal enclosure casing, not less than 1.0 mm (20 gauge) galvanized sheet steel, or 1.3 mm (18 gauge) aluminum fitted with suitable flanges to make clean airtight connections to ductwork.
Sound - absorbent material faced with glass fiber cloth 48 kg / m3 density / equivalent and covered with not less than 0,6 mm (24 gage) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gage) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be 48 kg/m3 density rigid fiberglass acoustic blanket. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to

2000 Pa (8 inches W.G.) at operating velocities. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.

Contractor to submit complete independent laboratory test data showing pressure drop and acoustical performance.

Till the attenuators are installed in place, the open ends of attenuators shall be capped at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

TECHNICAL DATA

All the Equipment data sheets to be submitted by the builder for review from the Services Consultant. Low side material and accessory details to be submitted by the HVAC Contractor.

a) AIR HANDLING UNIT / FCU:

1.1 Framework /Casing / Fans:

a) Manufacturer
b) Model no.
c) Material/Gauge
d) Frame work Material
e) Inner sheet casing
f) Outer sheet casing / thermal break
g) Fans
h) Fan curves attached
i) Details of Insulation (Material/Thickness)
j) Type of Bearing
k) Dia. of Fans (mm.)
l) No. of Fans
m) AHU Size - L mm.
- H mm.
- D mm.

n) Operating Weight (Kg.)
o) Type of Vibration isolators
p) Drain pan material, gauge, insulation

1.1 Coils:

a) Make
b) Face Velocity (FPM)
c) Material of tubes/fins
d) Pr. drop across coils (mm WG) – Water Flow
Air Flow
e) Dia of tubes (inch)
f) Rows deep for recirculation /TFA
g) Fins/Inch

1.2 Filters:

a) Make
b) Filter medium
c) Material of Frame Work
d) Filter face velocity (FPM)
e) Pressure output rated Air quantity (mm WG)

1.3 Motors:

a) Manufacturer

b) Motor HP
c) Type
d) Class of Insulation :
e) Electrical Characteristics :
f) Starting Current (Amps) :
g) Full Load Current (Amps) :
h) Motor Speed RPM :
i) Method of Starting
j) Starter manufacturer :

1.4. Air Handling Units / FCU's (Operating Data):

AHU/ FCU No.	Air Qty (CFM)	Coil Face Area (Sqft.)	Coil Vel. ((FPM)	Fan Outlet Vel. (FPM)	Fan Speed (RPM)	No. of Rows of Coil	Fan of Motor Hp	AHU/ FCU Opt. Wt.	Mixing Valve	
									mm dia	C value

Fan curves and selection :
AHU noise data sheet attached :
AHU noise level at 1m (dBA) :
AHU noise level at 3m (dBA) :

b) FANS:

Duct Mounted Inline Fans for Fresh & Exhaust air

S.No.	Type	Manufacturer	CFM	Static Pr. mm. wg.	Motor HP.	Outlet Vel. FPM	RPM	Type Of Drive	Noise Level DB

Axial /Centrifugal Fans for Smoke Extraction

S.No.	Type	Manufacturer	CFM	Static Pr. mm. wg.	Motor HP.	Outlet Vel. FPM	RPM	Type Of Drive	Noise Level DB

Fan curves and selection :
Fan noise data sheet attached
Fan noise level at 1m (dBA)
Fan noise level at 3m (dBA):

c) SOUND ATTENUATOR:

a) Attenuator Selection attached
b) Connecting duct size:
c) Attenuator size: - L mm. x D mm x H mm
d) Noise at Inlet to the Attenuator (dBA)

e) Noise at Outlet of the Attenuator (dBA)
f) Pressure drop across the attenuator (mm of w.g.)

d) INSULATION Ducting Acoustic Piping Lining

Manufacturer :
Materials :
Density :
Mean `K' value at 50oC ambient :
Mean `K' value at 35oC ambient :

e) DAMPERS (Make, Material & Gauge)

Fire & Smoke Dampers :
Splitter Dampers :
Volume Control Dampers :
Motorised Volume Control Damper :

f) GRILLES/ DIFFUSERS (Make, Material & Gauge)

L Bar Grills :
Grilles :
Diffusers :
Air Distributors :
Slot Diffusers :

g) LOUVERS (Make, Material & Gauge)

h) DAMPER ACTUATOR MOTORS (Make, Material & Gauge)

i) MOTORISED MODULTING DAMPER Submit Catalogue, Selection and Control wiring diagram

ELECTRICAL WORKS:

SCOPE

The scope of this section covers supply, erection, installation, testing and commissioning of electrical installation connected with the air conditioning work.

All structural/supports work required for installation of electrical panel, cables are to be included in scope of work by vendor.

STANDARDS

2.1 The following standards shall be applicable in addition to the relevant standards indicated in the sub-section.

a) IS: 732 COP for electrical wiring installation
b) IS: 1646 COP for fire safety of buildings, (General) electrical installation
c) IS: 5216 Guide for safety procedure & practice in electrical work
d) Indian Electricity Act and Rules

GENERAL REQUIREMENTS

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

Necessary wall/slab openings making and redoing for installation/erection of panels and cabling will be in HVAC Contractors scope whether specifically excluded/not mentioned elsewhere.

ELECTRICAL PANELS

The panels shall be cubicle, flush front free standing with individual feeders housed in separate enclosure and shall conform to IS: 8623, IS: 3072, IS: 2147, IS: 4047, IS: 2516, IS: 2529, IS: 3914 and IS: 5124. The ratings of feeders and accessories shall be selected for the fill load current of the equipment or the feeder load. The indicating and measuring instruments shall be 144 x 144 square. All incoming and outgoing feeders shall be with phase indicating lamps and ammeters. The panel fabrication drawings shall be got approved before taking up the fabrication work.

5.0 CABLING

All cables shall be PVC insulated, sheathed and armored cables with copper conductor upto 16 sq. mm and aluminium conductor of 25 sq. mm and above. The cables and the laying shall conform to IS: 4288/IS: 1255.

6.0 STARTERS

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

7.0 EARTHING

All electrical equipments, panels, starters, cabling and conduiting shall be earthened conforming to IS: 732 and IS: 3043.

The main earth grid shall be provided by others. The earthing conductors shall be as shown below:

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

100 kW and above	2 nos.	25 x 6 mm

8.0 INSTALLATION & TESTING

The panels shall be provided with ISMC 75 base framework and grouted to the floor or the pedestal provided. Individual starters, control station etc. shall be provided with ISA 25 frame support and grouted properly. Cables and earthing shall be laid in rents indicated and shall be supported on cable trays and clamped. Cables and earthing laid on floor shall be through PVC pipe sleeves buried in the floor or in cable trench.

8.2 The electrical installation shall be tested as indicated is IS: 732 and IS: 3043. The IR valves of panels and cables and the earth resistance shall be measured and recorded. The test reports shall be signed and submitted by the licensed electrical supervisor.

L) MODE OF MEASUREMENTS:

Mode of Measurement for payment of items of ducting & their insulation shall be as follows:

1.0 DUCTING:

Payment for ducting shall be on the basis of the external surface area of the ducting including all material and labour for installed duct. The rate per Sq. meter of the external surface shall include all wastage flanges, gaskets for joints, bolts and nuts, duct supports and hanger vibration isolation pads or suspenders, flexible connections, inspection doors, dampers running vanes, straight vanes, and any item which will be required to complete the external insulation and acoustic lining.

The external area shall be calculated by measuring the over all width and depth (including the corner joints) in the centre of the duct section from flange face to flange face in case of ducts length with uniform cross section. Total area will be arrived at by adding up the area of all duct sections.

In case of taper pieces average width and depth will be worked out as follows:

W 1 = Width of small cross section
W 2 = Width of large cross section
D 1 = Depth of small cross section
D 2 = Depth of large cross section

Average Width = (W 1 + W 2) / 2

Average Depth = (D 1 + D 2) / 2

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections flatted with angle iron flanges, otherwise at the bottom of the flange where the flanges are of duct sheet.

For circular pieces the diameter of the section midway between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface area of the taper piece. Duct measurements for calculation of area shall be taken before applications of insulation for the special pieces like bends, branches & tees etc, same principles of areas measurements as for liner and outer periphery along the curvature angle of the piece shall apply.

2.0 DUCT INSULATION/ACOUSTIC LINING:

This item is provided separately for various thickness and shall be paid for as per IS 14164.

GRILLS, DIFFUSERS AND LOUVERS:

All grills will be measured in terms of effective installed length. Diffusers shall be measured in terms of quantity (nos.) of each size installed.

DAMPERS:

Measurements for duct mounted volume control dampers shall be made on effective area (approx. equal of corresponding duct size) and measured in Sq.M.

ELECTRICAL CABLING/WIRING/EARTHING:

All equipments and related cabling from respective panels and upto the motor of the equipment is part of the equipment cost and hence no measurements will be made for these.

22.LIST OF APPROVED MAKES

FOR HVAC LOW SIDE WORKS

The scope of this section covers the recommended makes of equipments and material components. The tenderer shall quote his rates based on the price of the brand/make stipulated in the item of works as described in BOQ, specifications and furnished in Summary Sheets/Technical data. The owner reserves the right to select any of the brands indicated in the "List of Approved Makes" in case of delay in delivery of ordered `make of item'. The contractor cannot claim anything extra if the owner changes the make but within the list of approved make. Items for which makes are not recommended, contractor shall obtain approval from consultants prior to procurement.	
ITEM	APPROVED MAKES
REFRIGERATION MACHINES	
Double Skin Air Handling Units	Edge-Tech, Zeco , Vayhan Air control
Air Cooled DX system, Hi-wall Split Units,	Voltas, Bluestar, Daikin, LG
Copper pipes & Fittings	Nippon, Bundy, Mandev, Nissan, Rajco
Variable Frequency Drives:	Danfoss-HVAC Advanced
FANS	
Ventilation and Exhaust Equipment:	
Inline Axial Fans, Ductable Fans	Dyna air, Kruger, systemair
Smoke Extract Fans	Maico, Kruger, systemair
AIR DISTRIBUTION:	
GS sheets - LFQ as per IS 277	Jindal, SAIL-Bhilai, TATA, Uttam, Posco
Prefabricated GS Ducts as per IS 655	Nutech, Rolastar, Zeco, Asawa
Insulated flexible ducts	UP Twiga, Caryaire
GS Volume Control Dampers, Motorised Dampers, Backdraft Dampers	George-Rao, Dynacraft, Cosmos
Fire and Smoke Dampers	George-Rao, Dynacraft, Cosmos

Al. Louvers	George-Rao, Caryaire, Cosmos

ITEM	APPROVED MAKES
Aluminium Box Type Dampers	Air Products, Dynacraft
Grills and Diffusers	Air Products, Dynacraft
Damper Actuated Motors	Siemens, Belimo, Joventa
Sound Attenuators	Caryaire, Trox
Air Filters	Dyna Filters, Airtech, Camfil-Farr, Aspen, AAF
INSULATION:	
Glass wool (Fibre Glass)	UP Twiga, Owens Corning
Nitrile Foam / EPDM (Closed Cell)	Aeroflex, K-Flex, Armaflex
EPS	Modifoam, Beardsell
Tarfelt/CPRX Compound	Shalimar, Shalicoat
Miscellaneous:	
Vibration Isolators/Cushy Foot Mounts	Dunlop, Resistoflex
V-Belts	Dunlop, Fenner
Hardware	Sundaram Fastners, GKW
Anchor Fasteners	Shakti, Hilti
Paint	Nerolac, Asian
Welding Rods	ESAB, Advani-Orlecon
MV Switchgear and Ancillaries:	
MCCB / MCB / DB / RCCB	Legrand
Starters and Contactors	Siemens, L&T
Relays, Timers	Legrand
ITEM	APPROVED MAKES

Energy Meter	HPL Sochomech
Indicating Meters	L&T
Push Buttons	Legrand
Terminals, Connectors in Panels	Elmex, Connectwell
Cables	Polycab, KEI
Glands	Commet, Braco
Lugs	Jainson, Dowells
Wires	RR Kables,Polycab,KEI

Drawing List :-