

# JABALPUR SMART CITY LIMITED

## MADHYA PRADESH

Office of the Executive Director, JABALPUR SMART CITY LIMITED, Jabalpur (M.P.)

### TENDER DOCUMENT

NIT Number and Date : \_\_\_\_\_

Agreement Number and Date : \_\_\_\_\_

Name of Work : Construction of Underground Intimate Theater with Interior work, Allied Services work and Landscaping at Bhawartal Park, Jabalpur (M.P.).

Name of the Contractor : \_\_\_\_\_

Probable Amount of Contract  
(Rs. In Figure) : 14,11,00,000.00/-  
(Rs. In Words) : Rupees Fourteen Crore Eleven Lacs Only

Contract Amount  
(Rs. In Figure) : \_\_\_\_\_  
(Rs. In Words) : \_\_\_\_\_

Stipulated Period of Completion: **18 months i/c rainy season.**

# Tender Document

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**SECTION 1**  
**Notice Inviting e-Tenders**

**JABALPUR SMART CITY LIMITED**

N.I.T. NO \_\_\_\_\_/e-tendering

Dated 14<sup>th</sup> Sept 2017

Online percentage rate bids for the following works are invited from registered contractors and firms of repute fulfilling registration criteria:

S.No./Pkg /Code	Work	District(s)	Probable Amount (Rs. In lacs)	Completion Period (months)
	Construction of Underground Intimate theater with Interior work, Allied Services work and Landscaping at Bhawartal Park, Jabalpur (M.P.).		1411.00 Lacs	18 months

1. Interested bidders can view the NIT on website <http://www.mpeproc.gov.in>
2. The Bid Document can be purchased only online from 10.00 am on 14<sup>th</sup> Sept 2017 to 10<sup>th</sup> Oct 2017
3. Amendments to NIT, if any, would be published on website only, and not in newspaper.

Signature and Designation

# Notice Inviting Tenders

## JABALPUR SMART CITY LIMITED

Office of The Executive Director, JABALPUR SMART CITY LIMITED, Jabalpur (M.P.)

N.I.T.NO. \_\_\_\_\_/e-tendering

Dated 14<sup>th</sup> Sept 2017

Online percentage rate bids for the following works are invited from registered contractors and firms of repute fulfilling registration criteria:

S.no./ Pkg /Code	Name of Work	District(s)	Probable Amount of Contract (Rs. In lacs)	Earnest Money Deposit (EMD) (in Rupees)	Cost of Bid Document (in Rupees)	Category of Contractor	Period of completion (in Months)
	Construction of Underground Intimate theater with Interior work, Allied Services work and Landscaping at Bhawartal Park, Jabalpur (M.P.).	Jabalpur	Rs.1411.00 lacs	Rs 10,00,000.00/-	Rs 30,000.00/-	As per required	18 months including Rainy Season

1. All details relating to the Bid Document(s) can be viewed and downloaded free of cost on the website.
2. Bid Document can be purchased after making online payment of portal fees through Credit/Debit/Cash Card/ internet banking.
3. At the time of submission of the bid the eligible bidder shall be required to:
  - I. Pay the cost of bid document.
  - II. Deposit the Earnest Money
  - III. Submit a check list and
  - IV. Submit an affidavit.Details can be seen in the Bid Data Sheet.

#### **4. Eligibility for bidders:**

At the time of submission of the bid the bidder should have valid registration with the Government of Madhya Pradesh, PWD in appropriate class; However, such bidders who are not registered with the Government of Madhya Pradesh and are eligible for registration can also submit their bids after having applied for registration with appropriate authority.

(a) The bidder would be required to have valid registration at the time of signing of the Contract.

(b) Failure to sign the contract by the selected bidder, for whatsoever reason, shall result in forfeiture of the earnest money deposit.

5. **Pre-qualification** – Prequalification conditions, wherever applicable, are given in the Bid Data Sheet.
6. **Special Eligibility-** Special Eligibility Conditions, if any, are given in the Bid data sheet.
7. The Bid Document can be purchased only online from **10.00 am on 14<sup>th</sup> Sept 2017** to time **23.59 on 10<sup>th</sup> Oct 2017**. The key dates may be seen in bid data sheet.
8. The Pre Bid meeting will be held on **27<sup>th</sup> Sept 2017 at 15:00** (03:00 pm) onwards at JSCL Office, Manas Bhawan, Wright Town, Jabalpur.
9. Amendments to NIT, if any, would be published on website only, and not in newspaper.

(Signature and Designation)

## SECTION 2

# INSTRUCTIONS TO BIDDERS (ITB)

### A.GENERAL

#### 0. BACKGROUND

Bhawartal Park Rejuvenation is a part of a larger smart city plan which involves improvement of parks and landscape in order to improve the outdoor air quality. The smart city plan aims to establish Ranital Park and Bhawartal Park as two important green nodes of the city. Redevelopment of the site is hence, an important milestone in the growth of city. The city further, lacks sufficient public and semi-public facilities for the people. Suitable facilities should be developed which sensitize and entertain the crowd at large.

J.S.C.L. has envisaged an Intimate Theatre at a part of Bhawartal park. An intimate theatre is an evolving concept, capable of incorporating the traditional art form as well as alternative theatric approaches. Hence, establishing Bhawartal as a theatrics hub of the city is a wise and apt solution Jabalpur should look forward to. The site is set on a pedestrian walkway, at the edge of a green landscape. The courts, OAT's and the stretching greens provide apt spill over space for the development. No additional catalyst will be required to pull the crowd to the development once the Cultural Street is fully functional.

The theatre is envisaged on a unique concept of merging the development with the surrounding landscape of Bhawartal Park. The auditorium is therefore, sunk into the ground, creating the possibility of the green landscape of Bhawartal Park to extend onto the roof of the building. The roof is connected with earthen mounds and ramps for easy connectivity of people and easy access for public of all ages and types. While the roof will be a green extension and spill out for the cultural street, a state of the art auditorium will remain unique incubation center for arts and theatrics for the entire region. The very cozy and intimate 225 capacity auditorium will be developed equipped with the best of finishes and technology for proper promotion of theatrics, film festivals and other allied fields of art. The Intimate Theater project will therefore be a public space in the true sense.

#### 1. SCOPE OF BID

The detailed description of work, hereinafter referred as 'work' is given as below:

**Construction of Underground Intimate Theater with Interior work, Allied Services work and Landscaping at Bhawartal Park, Jabalpur (M.P.).**

**2. GENERAL QUALITY OF WORK:**

The work shall have to be executed in accordance with the technical specifications specified in the Bid Data sheet/ Contract Data, and shall have to meet high standards of workmanship, safety and security of workmen and works.

**3. PROCEDURE FOR PARTICIPATION IN E- TENDERING:**

The procedure for participation in e-tendering is given in the Bid Data Sheet.

**4. ONE BID PER BIDDER**

4.1 The bidder can be an individual entity or a joint venture (if permitted as per Bid Data Sheet). In case the J.V. is permitted, the requirement of joint venture shall be as per the Bid Data Sheet.

4.2 No bidder shall be entitled to submit more than one bid whether jointly or severally. If he does so, all bids wherein the bidder has participated shall stand disqualified

**5. COST OF BIDDING:**

The bidder shall bear all costs associated with the preparation and submission of his bid, and no claim whatsoever for the same shall lie on the Government/J.S.C.L..

**6. SITE VISIT AND EXAMINATION OF WORKS:**

The bidder is advised to visit and inspect the site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the work. All costs in this respect shall have to be borne by the bidder.

## **B.BID DOCUMENTS**

**7. CONTENT OF BID DOCUMENTS:**

The Bid Document comprises of the following documents:

1. NIT with all amendments.
2. Instructions to Bidders, Bid Data Sheet with all Annexure
3. Conditions of Contract:
  - I. Part I General Conditions of contract and the Contract Data with all Annexure, and
  - II. Part II Special Condition of Contract.
4. Specifications
5. Drawings
6. Priced bill of quantities
7. Technical and Financial bid
8. Letter of Acceptance

9. Agreement, and
10. Any other document(s), as specified

**8.** The bidder is expected to examine carefully all instructions, conditions of contract, the **Contract data**, forms, terms and specifications, bill of quantities, forms and drawings in the bid document, Bidder shall be solely responsible for his failure to do so.

**9. PRE-BID MEETING (WHERE APPLICABLE)**

Wherever the Bid Data Sheet provides for pre-bid meeting:

- 9.1 Details of venue, date and time would be mentioned in the Bid Data Sheet. Any change in the schedule of pre-bid-meeting would be communicated on the website only, and intimation to bidders would not be given separately.
- 9.2 Any prospective bidder may raise his queries and/or seek clarifications in writing before or during the pre-bid meeting. The purpose of such meeting is to clarify issues and answer questions on any matter that may be raised at that stage. The Employer may, at his option, give such clarifications as are felt necessary.
- 9.3 Minutes of the pre-bid meeting including the gist of the questions raised and the responses given together with any response prepared after the meeting will be hosted on the website.
- 9.4 Pursuant to the pre-bid meeting, if the employer deems it necessary to amend the bid Documents, it shall be done by issuing amendment to the online NIT.

**10. AMENDMENT OF BID DOCUMENTS:**

- 10.1 Before the deadline for submission of bids, the Employer may amend or modify the bid document by publication of the same on the website.
- 10.2 All amendments shall form part of the Bid Document.
- 10.3 The Employer may, at its discretion, extend the last date for submission of bids by publication of the same on the website.

**C. PREPARATION OF BID**

**11.** The bidders have to prepare their bids online, encrypt their Bid Data in the Bid Forms and submit Bid Seals (Hashes) of all the envelopes and documents related to the bid required to be uploaded as per the time schedule mentioned in the key dates of the Notice Inviting e-tenders after signing of the same by the Digital Signature of their authorized representative.



## 12. DOCUMENTS COMPRISING THE BID:

The bid submitted online by the bidder shall be in the following parts:

Part1- This shall be known as online Envelop A and would apply for all bids. Online envelop A shall contain the following as per details given in the bid data sheet:

- i) Registration number or proof of application for registration and organizational details in the format given in the bid data sheet.
- ii) Payment of the cost of Bid Document.
- iii) Earnest Money
- iv) An Affidavit Duly Notarized.

**Part 2** – This shall be known as Online **Envelope B** and required to be submitted only in work where pre-qualification conditions and / or special eligibility conditions are stipulated in the Bid Data Sheet. Online **envelop B** shall contain a self-certified sheet duly supported by documents to demonstrate fulfillment of pre-qualification conditions.

**Part 3-** This shall be known as online **Envelope C** and would apply to all bids. Envelop C shall contain financial offer in the prescribed format enclosed with the Bid Data Sheet.

## 13. LANGUAGE:

The bid as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer shall be in English or Hindi. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English. In such case, for the purposes of interpretation of the bid, such translation shall govern.

## 14. TECHNICAL PROPOSAL:

- 14.1. Only, in case of bids with pre-qualification conditions defined in the Bid Data Sheet, the Technical Proposal shall comprise of formats and requirements given in the Bid Data Sheet.
- 14.2. All the documents/ information enclosed with the Technical Proposal should be self-attested and certified by the bidder. The Bidder shall be liable for forfeiture of his earnest money deposit, if any document/information are found false/fake/untrue before acceptance of bid. If it is found after acceptance of the bid, the bid sanctioning authority may at his discretion forfeit his performance security / guarantee, security deposit, enlistment deposit and take any other suitable action.

## 15. FINANCIAL BID:

- i) i. The bidder shall have to quote rates in format referred in Bid Data Sheet, in overall percentage, and not item wise. If the bid is in absolute amount, overall percentage would be arrived at in relation to the probable amount of contract given in NIT. The overall percentage rate would apply for all items of work.

- ii) Percentage shall be quoted in figures as well as in words. If any difference in figures and words is found, lower of the two shall be taken as valid and correct.
- iii) The bidder shall have to quote rates inclusive of all duties, taxes, royalties and other levies; and the Employer shall not be liable for the same.
- iv) The material along with the units and rates, which shall be issued, if any, by the department to the contractor, is mentioned in the Bid Data Sheet.

**16. PERIOD OF VALIDITY OF BIDS:**

The bids shall remain valid for a period specified in the Bid Data Sheet after the date of "close for bidding" as prescribed by the Employer. The validity of the bid can be extended by mutual consent in writing.

**17. EARNEST MONEY DEPOSIT (EMD)**

- 17.1 The Bidder shall furnish, as part of the Bid, Earnest Money Deposit (EMD), in the amount specified in the Bid Data Sheet.
- 17.2 The EMD shall be in the form of Fixed Deposit Receipt of a scheduled commercial bank, issued in favors of the name given in the Bid Data Sheet. The Fixed Deposit Receipt shall be valid for six months or more after the last date of receipt of bids. However, form(s) of EMD may be allowed by the employer by mentioning it in the Bid Data Sheet.
- 17.3 Bid not accompanied by EMD shall be liable for rejection as non-responsive.
- 17.4 EMD of bidders whose bids are not accepted will be returned within ten working days of the decision on the bid.
- 17.5 EMD of the successful Bidder will be discharged when the Bidder has signed the Agreement after furnishing the required Performance security.
- 17.6 Failure to sign the contract by the selected bidder, within the specified period, for whatsoever reason, shall result in forfeiture of the earnest money.

**D.SUBMISSION OF BID**

- 18. The bidder is required to submit online bid duly signed digitally, and envelop "A" in physical form also at the place prescribed in the Bid Data Sheet.

## **E. OPENING AND EVALUATION OF BID**

### **19. PROCEDURE:**

- 19.1 Envelop "A" shall be opened first online at the time and date notified and its contents shall be checked. In cases where Envelop "A" does not contain all requisite documents, such bid shall be treated as non-responsive, and envelop B and / or C of such bid shall not be opened.
- 19.2 Wherever Envelop 'B' (Technical Bid) is required to be submitted, the same shall be opened online at the time and date notified. The bidder shall have freedom to witness opening of the envelop 'B' envelop 'C' (financial bid) of bidders who are not qualified in Technical Bid (Envelop 'B') shall not be opened.
- 19.3 Envelop 'C' (Financial Bid) shall be opened online at the time and date notified. The bidder shall have freedom to witness opening of the Envelop 'c'
- 19.4 After opening Envelop 'C' all responsive bids shall be compared to determine the lowest evaluated bid.
- 19.5 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all the bids at any time prior to contract award, without incurring any liability. In all such cases reasons shall be recorded.
- 19.6 The employer reserves the right of accepting the bid for the whole work or for a Distinct part of it.

### **20. CONFIDENTIALITY:**

- 20.1 Information relating to examination, evaluation, comparison and recommendation of contract award shall not be disclosed to bidders or any other person not officially concerned with such process until final decision on the bid.
- 20.2 Any Attempt by a bidder to influence the employer in the evaluation of the bids or contract award decisions may result in the rejection of his bid.

## **F. AWARD OF CONTRACT**

### **21. AWARD OF CONTRACT:**

The Employer shall notify the successful bidder by issuing a 'Letter of Acceptance' (LOA) that his bid has been accepted.

### **22. PERFORMANCE SECURITY**

- 22.1 Prior to signing of the contract the bidder to whom LOA has been issued shall have to furnish performance security of the amount in the form and for the duration, etc. as specified in the Bid Data Sheet.

22.2 Additional performance security, if applicable, is mentioned in the Bid data sheet and shall be in the form and for the duration, etc. similar to Performance Security.

**23. SIGNING OF CONTRACT AGREEMENT:**

23.1 The successful bidder shall have to furnish Performance Security and Additional Performance Security, if any, and sign the contract agreement within 15 days of issue of LOA

23.2 The signing of contract agreement shall be reckoned as intimation to commencement of work. No separate work order shall be issued by the employer to the contractor for commencement of work.

23.3 In the event of failure of the successful bidder to submit Performance Security and Additional Performance Security, if any or sign the Contract Agreement, his EMD shall stand forfeited without prejudice to the right of the employer for taking any other action against the bidder.

**24. CORRUPT PRACTICES:**

The Employer requires that bidders observe the highest standard of ethics during the procurement and execution of contracts. In pursuance of this policy, the employer.

- i. May reject the bid for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract; and
- ii. May debar the bidder declaring ineligible, either indefinitely or for a stated period of time, to participate in bids, if it at any time determines that the bidder has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for, or in executing, a contract.

For the purposes of this provision, the terms set forth above are defined as follows:

- a. 'corrupt practice' means the offering, giving, receiving or soliciting directly or indirectly, anything of value to influence improperly the actions of another party;
- b. 'fraudulent practice' means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a fanatical or other benefit or to avoid an obligation;
- c. 'coercive practice' means impairing of harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party,
- d. 'collusive practice' means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

**(END OF ITB)**

## BID DATA SHEET

### GENERAL

SR.NO.	PARTICULARS	DATA
1	OFFICE INVITING TENDER	OFFICE OF THE EXECUTIVE DIRECTOR, JABALPUR SMART CITY LIMITED, JABALPUR.
2	NIT NO.	
3	DATE OF NIT	14 <sup>TH</sup> SEPT 2017
4	BID DOCUMENT DOWNLOAD AVAILABLE FOR DATE & TIME	THE BID DOCUMENT CAN BE PURCHASED ONLY ONLINE FROM 10.00 AM ON 14 <sup>TH</sup> SEPT 2017 TO TIME 23.59 ON 10 <sup>TH</sup> OCT 2017
5	WEBSITE LINK	<a href="http://www.mpeproc.gov.in">http://www.mpeproc.gov.in</a>

### SECTION 1 – NIT

CLAUSE REFERENCE	PARTICULARS	DATA
1	PORTAL FEES	AS NOTIFIED IN E-TENDERING WEBSITE
2	COST OF BID DOCUMENT	RS 30,000/- (RUPEES THIRTY THOUSAND ONLY)
	COST OF BID DOCUMENT PAYABLE AT	<b>As notified in e-tendering website</b>
	COST OF BID DOCUMENT IN FAVOR OF	<b>As notified in e-tendering website</b>
3	AFFIDAVIT FORMAT	ANNEXURE B
4	PRE-QUALIFICATIONS REQUIRED	YES
	IF YES, DETAILS	AS PER ANNEXURE C
5	SPECIAL ELIGIBILITY	YES
	IF YES, DETAILS	<b>AS PER ANNEXURE D</b>
6	KEY DATES	ANNEXURE A

### SECTION 2 – ITB

CLAUSE REFERENCE	PARTICULARS	DATA
1	NAME OF 'WORK'	CONSTRUCTION OF UNDERGROUND INTIMATE THEATER WITH INTERIOR WORK, ALLIED SERVICES WORK AND LANDSCAPING AT BHAWARTAL PARK, JABALPUR (M.P.).

2	SPECIFICATIONS	AS PER ANNEXURE –E
3	PROCEDURE FOR PARTICIPATION IN E-TENDERING	ANNEXURE-F
4	WHETHER JOINT VENTURE IS ALLOWED	NO
5	PRE BID MEETING TO BE HELD	YES
	DATE, TIME & PLACE	DATE: 27 SEPT 2017 TIME AT 15:00 ONWARDS (03:00 PM ONWARDS)  PLACE: J.S.C.L OFFICE, MANAS BHAWAN, WRIGHT TOWN, JABALPUR.
6	ENVELOPMENT A CONTAINING: i. REGISTRATION NUMBER OR PROOF OF APPLICATION FOR REGISTRATION AND ORGANIZATIONAL DETAILS AS PER ANNEXURE H ii. COST OF BID DOCUMENT iii. EMD iv. AN AFFIDAVIT DULY NOTARIZED AS PER ANNEXURE – B SHOULD REACH IN PHYSICAL FORM	OFFICE OF THE EXECUTIVE DIRECTOR, JABALPUR SMART CITY LIMITED, JABALPUR (M.P.)  RS 30,000.00/- RS 10,00,000.00/- BEFORE 23 <sup>RD</sup> OCT 2017
7	ENVELOPE-B TECHNICAL PROPOSAL	ANNEXURE – I AND ANNEXURE –I (FORMAT I-1 TO I-5)
8	ENVELOPE-C FINANCIAL BID	ANNEXURE – J
9	MATERIALS TO BE ISSUED BY THE DEPARTMENT	ANNEXURE-K
10	PERIOD OF VALIDITY OF BID	120 DAYS
11	EARNEST MONEY DEPOSIT	RS 10,00,000.00/-
	FORMS OF EARNEST MONEY DEPOSIT	FDR/E-FDR
	EMD VALID FOR A PERIOD OF	180 DAYS
	FDR MUST BE DRAWN IN FAVOUR OF	EXECUTIVE DIRECTOR, JABALPUR SMART CITY LIMITED
12	LETTER OF ACCEPTANCE (LOA)	ANNEXURE L
13	AMOUNT OF PERFORMANCE SECURITY	5% OF CONTRACT AMOUNT
	ADDITIONAL PERFORMANCE	as per rules

	SECURITY, IF ANY	
	PERFORMANCE SECURITY IN THE FORMAT	ANNEXURE M
	PERFORMANCE SECURITY IN FAVOR OF	EXECUTIVE DIRECTOR, JABALPUR SMART CITY LIMITED
	PERFORMANCE SECURITY VALID UP TO	VALID CONTRACT PERIOD PLUS 3 MONTHS

## KEY DATES

S.N O	WORKS STAGE	BIDDERS STAGE	START		EXPIRY		ENVELOPE S
			DATE	TIME	DATE	TIME	
1	TENDER PURCHASE	PURCHASE OF TENDER – ONLINE	14 <sup>TH</sup> SEPT 2017		10 <sup>TH</sup> OCT 2017	23:59	
2	TENDER FILING	BID SUBMISSION – ONLINE	14 <sup>TH</sup> SEPT 2017		17 <sup>TH</sup> OCT 2017		
3	MANDATORY SUBMISSION OPEN (ENVELOPE-A)	-	23 <sup>RD</sup> OCT 2017		23 <sup>RD</sup> OCT 2017		ENVELOPE A
4	TECHNICAL PROPOSAL OPEN (PQ ENVELOPE-B)		24 <sup>TH</sup> OCT 2017	10:30	24 <sup>TH</sup> OCT 2017		ENVELOPE B
5	FINANCIAL BID OPEN (ENVELOPE-C)		25 <sup>TH</sup> OCT 2017	10:30	25 <sup>TH</sup> OCT 2017		ENVELOPE C

Original term deposit receipt of earnest money deposit, demand draft for the cost of bid document and affidavit shall be submitted by the bidder so as to reach the office as prescribed in bid data sheet, at least one calendar day before specified start time and date in key dates for opening of technical proposal as per key dates in Bid Data Sheet.



**|| AFFIDAVIT ||**

**(To be Contained in Envelope A)**

*(On Non Judicial stamp of Rs. 100)*

I/We \_\_\_\_\_ who is / are \_\_\_\_\_ (status in the firm / company) and competent for submission of the affidavit on behalf of M/S \_\_\_\_\_ (contractor) do solemnly affirm an oath and state that:

I/We am / are fully satisfied for the correctness of the certificates/ records submitted in support of the following information in bid documents which are being submitted in response to notice inviting e-tender No. \_\_\_\_\_ for \_\_\_\_\_ (name of work) dated \_\_\_\_\_ issued by the \_\_\_\_\_ (name of the Department).

I/We am/ are fully responsible for the correctness of following self- certified information / documents and certificates.

1. That the self – certified information given in the bid document is fully true and authentic.
2. That:
  - a. Term deposit receipt deposited as earnest money, demand draft for cost of bid document and other relevant documents provided by the Bank are authentic.
  - b. Information regarding financial qualification and annual turnover is correct.
  - c. Information regarding various technical qualifications is correct.
3. No. close relative of the undersigned and our firm/company is working in the department.

**Or**

Following close relatives are working in the department:

Name \_\_\_\_\_ - Post \_\_\_\_\_ present Posting \_\_\_\_\_

Signature with seal of the Deponent (bidder)

I/We, \_\_\_\_\_ above deponent do hereby certify that the facts mentioned in above paras 1 to 4 are correct to the best of my knowledge and belief.

Verified today \_\_\_\_\_ (dated) at \_\_\_\_\_ (place).

**Signature with seal of the Deponent (bidder)**

Note: Affidavit duly notarized in original shall reach at least one calendar day before opening of the bid.

## PRE- QUALIFICATIONS CRITERIA

**The bidder should have:**

**A. Financial**

- I. experience of having successfully executed: -
  - i. **three similar works**, each costing not less than the **amount equal to 20%** of the probable amount of contract during the **last 3 financial years**; or
  - ii. **two similar works**, each costing not less than the **amount equal to 30%** of the probable amount of contract during the **last 3 financial years**; or
  - iii. **one similar work** of aggregate cost not less than the amount **equal to 50%** of the probable amount of contract in any one financial year during the **last 3 financial years**;
- ii. Average annual construction turnover on the construction works not less than **50%** of the probable amount of contract, i.e. not less than 7.5 crore per year, during the last 3 financial years.
- iii. Executed similar items of work in any one financial year during the last 3 financial years, which should not be less than the minimum, physical requirement, if any, fixed for the work.
- iv. Bid Capacity — Bidder shall be allotted work up to his available Bid Capacity, which shall be worked out as given in format 1-2 of Annexure I.

**B. Physical**

Physical qualifications for the work shall be as below

S.No	Physical qualification required	Quantity	Period
1	Basement Work	At least one work of 750 sqm. basement built-up area in (high) water table areas.	in any one of the last 3 financial years
2	Concrete work	At least one work of 1500 sqm built-up area, and 1200 cum of controlled RMC work under high water table areas	in any one of the last 3 financial years
	Comprehensive construction contracts	including Civil work, Interior finishing, all	

		<p>allied services such as Fire-fighting sprinkler system, HVAC/ MEP, acoustics and Landscaping with excellent workmanship.</p>	
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Note:

- i) The bidder will have to provide certificates for above prequalifying conditions from competent authority.
- ii) The bidder should attach a PowerPoint presentation of not more than 20 slides exhibiting exemplary work.

**SPECIAL ELIGIBILITY CRITERIA**  
**{NOT APPLICABLE}**

## **SPECIFICATIONS**

### **GENERAL NOTES**

1. SOR of UADD / MPPWD/ CPWD Department for all works is used for Items and specifications for this project and form a part of this document.
2. Electrical items to be used shall be taken from the list of makes as approved by UADD / MPPWD.
3. Detailed specifications for Non-scheduled items are also included in the document however, in case if any specification is incomplete or missing or not clear or needs further clarifications, the decision of Employer shall be binding in this regard.
4. The provisions of general / special conditions of contract, those specified elsewhere in the bid document, as well as execution drawings and notes, or other specifications issued in writing by the Employer shall form part of the technical specifications of this work.

### **Specifications of Non-Scheduled Items:**

#### **1) FIRE ALARM SYSTEM**

The Fire Alarm System shall conform to national standards in respect of design and installation, and it shall give Audio/Visual Alarm Signals when there is rise in temperature in case of Heat Detector or while measuring Smoke Density in case of Smoke Detector, while it exceeds the pre-set limit. The system shall give zone location of fire with warning system and voice communication for commands and instruction if required.

The basic function of the system shall be able to achieve location of alarm indication.

It shall be possible to load each zone with up to 20 Detectors/MCP in a circuit.

Annunciation facility shall also be inbuilt into the FACP, the panel being able to initiate alarm signal for any particular zone.

The system shall be fully supervised for all fault conditions with distinctive alarm operated for fault and fire conditions.

The system shall be based on an "Open Protocol" to ensure flexibility of using Sensors / Detectors of an alternate manufacturer, in case the user requires such an option at a later date.

## **FIRE ALARM CONTROL PANEL (FACP)**

The Fire Alarm Control Panel shall be micro controller based conventional Panel which shall control all controller units and Switching Systems (for disconnecting AHU and power supply) connected to it.

Conventional fire alarm panels shall have several detection lines or 'zones' which consist of a mixture of conventional smoke or heat detectors and manual call points limits the area of a building which can be protected by a single zone of detectors. This is partly in order to ensure that in case of a wiring fault, only a small part of the system is prevented from functioning and partly so that the location of a fire can be determined at the fire alarm panel and limited to a sufficiently manageable search area.

The detection line is normally supplied with 24Volts DC. Conventional fire alarm systems use an end-of-line device to allow the control panel to verify that there are no breaks in the wiring. In simple systems a resistor may be used as the end-of-line device. The end-of-line device draws a constant current which is higher than the standby current drawn by the smoke detectors and heat detectors, but lower than their normal alarm current. If the cable is broken, the control panel detects that the end-of-line device is no longer drawing current and signals a fault.

When there is no alarm condition, the smoke and heat detectors draw a low standby current. Should the detector sense smoke, it latches into an alarm condition with its LEDs illuminated, drawing a high current. The control panel senses the high current drawn, illuminates its fire LED and activates the sounder lines. The fire detector will remain latched in its alarm condition even if it no longer senses smoke, until it is reset by the control panel momentarily removing power from the detection lines. Latching the detector ensures that the location of the fire can be found even if the detector is only sensing smoke intermittently. It also ensures that it is possible to locate which detector caused the alarm, should a false alarm have been caused by a smoke detector located close to a toaster, for example!

When the detector is in its alarm state, the voltage across the detector is normally around 14 Volts. This allows the panel to distinguish between an alarm condition and a short circuit condition caused by a wiring fault. If a short circuit occurs the voltage across the lines will be zero.

A manual call-point consists of a simple switch with a resistor in series with it, usually 820 Ohms or 1k Ohms. The resistor limits the amount of current drawn by the call point in alarm, so that the panel can distinguish between an alarm condition and a short circuit condition.

The control panel should therefore be able to distinguish between four states. The table below shows how a typical panel could identify the four states. The figures will vary from panel to panel but the principle of operation is the same.

Short / Open circuit units shall also be reported at the FACP. The missing Detectors/Devices shall also be reported at the FACP with identification of the group location.

The FACP also is able to actuate switches automatically in case of Fire condition that of AHU's and power supply or other systems etc.

The Bidder shall undertake the responsibility of the complete installation, commissioning, user trials, training and maintenance of the System as required.

The FACP shall have its own Battery Backup of a minimum of 24 hours in normal condition and then half an hour in alarm condition. The Battery shall be 2\*12V (24V) DC and of sealed lead acid rechargeable maintenance free type, housed inside the FACP.

It shall be able to withstand temperature variations from 0° centigrade to 55° centigrade. Further, Relative Humidity (non-condensing type) up to 95% shall not hamper its performance. The voltage rating shall be from 18V DC to 26V DC, though the voltage may be change depending upon the working voltages of a proprietary FACP.

The FACP shall be metal enclosed, sheet steel cubicle pattern, dead front, floor/wall mounting type as required and suitable for indoor mounting. The FACP shall be of completely solid stage design. Doors shall be lockable.

The system shall be designed such that it shall be possible to add at least 20% of the Detectors for future expansion without extra cost on the panel.

The FACP shall have provision for interfacing with the Public Address System.

The Panel should have zones as per BOQ and each zone shall have an LED to indicate independently fire, open, short and isolate conditions on the panel fascia.

The FACP shall monitor the status of each Fire Zone and shall be configured to include:

a) **Microprocessor** based electronic panel complete with a fascia to provide the following indications, controls, ON site programmable Key Pad, suitable for RS-485 communication, having LCD display EPROM event logging.:

- "FIRE" indication one per zone
- "FAULT" indication one per zone
- "ZONE ISOLATE" one per zone through software
- "DETECTOR FAILURE - OPEN CIRCUIT - SHORT CIRCUIT" indication
- "BREAK IN WIRING" indication with initiation of alarm
- "KEY PAD" for ON site programming
- "LED & LCD Indication"

b) Mother Board to control and monitor the entire System with audio/visual alarms and with a fascia to provide the following controls and indications:

- "MAINS ON" indication
- "BATTERY MODE" indication
- "BATTERY LOW" indication
- "BATTERY FAULT" indication
- "LAMP TEST" push button
- "ZONE ON" indication
- "SYSTEM RESET" push button
- "ALARM SILENCE" push button

c) Power Supply for the System integral with the FACP. The power supply rating shall be adequate for the Detectors, Illuminated Signs and all other devices as required in the System.

The power supply unit integral with the Control Panel shall consist of a 230V AC to 24V DC SMPS.

d) Screw type terminal blocks and cable glands for termination of all control wiring.

e) Required potential free spare contacts/ or as called for in Bill of Quantities.

f) End of Line resistors as required by the System design shall be provided as a part of the Control Panel.

## **ELECTRONICS**

The Printed Circuit Board electro tinned copper tracks shall be protected from corrosion by a green epoxy solder resist coating. The tracks and solder joints shall be protected against fungus growth by an insulating varnish coating. The sensitive electronic components shall be protected by a high resistivity silicone encapsulation compound. All electronic components shall be electro statically screened. The electronic design and circuit shall provide protection against high voltage spikes on the supply line

## **MANUAL CALL POINTS**

Manual Call Points shall consist of a push button switch housed in a dust tight sheet metal enclosure to manually initiate audio visual alarms. The front shall be sealed with a breakable glass cover fixed in such a way that the actuating push button is kept depressed as long as the glass is intact and released automatically when the glass is broken.

A small steel hammer shall be attached to the assembly with a steel chain to facilitate breaking of the glass front. The Manual Call Box shall be suitable for surface or recessed mounting as required. The words "IN CASE OF FIRE BREAK GLASS" 5 mm high shall be painted in red on the front face.

### **HOOTER**

Electronic audio alarm Hooter shall be suitable for operation on the System and will be actuated from the Main Control Panel in the event of a fire. The alarm signal for continuous service with an output of 80 Db.

### **RESPONSE INDICATOR**

- The Response Indicator shall glow clearly in case the detector to which it is connected gives an alarm signal. The word "FIRE"/ Fire Symbol shall be clearly written on the visible face of the box. There shall be two numbers of red LEDs to compensate for fusing of either LEO.
- Response Indicator shall be provided in M.S. fabricated box or in plastic molded case.
- Response indicator of LED type shall be provided outside the rooms/ above false ceiling/ below false ceiling for indication of fire through detector.

### **PHOTO ELECTRIC TYPE SMOKE DETECTORS**

#### **GENERAL**

The Photo Electric Type Smoke Detectors shall be capable of sensing fire in the smoldering or the incipient stage. Smoke Detectors shall be sensitive to products of combustion of all materials like wood, paper, rubber, natural and synthetic fibers, plastic and common liquid hydrocarbons in accordance with the sensitivity requirements

#### **CONSTRUCTIONAL FEATURES**

##### **DETECTOR HEAD**

The Smoke Detector enclosure shall be of white plastic molded with high impact self-extinguishing polycarbonate and shall be fitted to the base by a twist and lock action. Correct alignment of the electrical contacts in the base with the terminal pins of the Detector shall be ensured. The twist and lock action shall ensure a good electrical contact with the wiping action. Apertures in the Detector housing shall allow the free ingress of smoke through stainless steel gauze and into the fire sensing photo-optic chamber.

##### **DETECTOR BASES**

The Detector bases shall be suitable for mounting directly on round box or as required at the site. The bases shall have terminals which shall be suitable for receiving 1.5 sq. mm PVC copper conductor cables. Access to the terminals shall be available from the front of the base after removing the Detector.

##### **LED INDICATION LAMP**

A LED lamp shall be incorporated which shall normally flicker indicating alertness and shall turn steady when a fire is sensed enabling immediate identification of the Detector.

Two number LED should be provided for 360° visibility.

##### **ELECTRONICS**

The Printed Circuit Board electro tinned copper tracks shall be protected from corrosion by a green epoxy solder resist coating. The tracks and solder joints shall be protected against fungus growth by an insulating varnish coating.

The sensitive electronic components shall be protected by a high resistivity silicone encapsulation compound. All electronic components shall be electro statically screened.

The electronic design and circuit shall provide the following safety devices:

- Protection against polarity reversal
- Protection against high frequency transients
- Detection of alarm at the control unit even in the event of LED failure
- Protection against transient spikes on long lead lines to the remote indicators

#### **OPERATIONAL PARAMETERS**



The Detectors shall be suitable for operation at a maximum ambient temperature of 60-degree C. and a minimum of 0-degree C with a maximum relative humidity of 93%. The Detector sensitivity shall remain constant and not vary with change in the ambient temperature, humidity, pressure or voltage by more than +/- 10%. The performance of the Detectors shall not be affected by continuous air flows up to 10 meters per second. The Detectors shall be suitably protected against the accumulation of dust and insects.

#### **DETECTOR CERTIFICATION**

The Smoke Detector shall be tested and approved by IS: 2189 or IS: 15908 or IS: 11360 through Approved LAB for certified Compliance and acceptance to the relevant Standards. The Detectors shall be approved by the Local Fire Authorities and relevant documentation shall be supplied with the tender.

#### **TEST CERTIFICATES**

Test certificate should be provided by Manufacturer.

#### **HEAT SENSITIVE RATE OF RISE CUM FIXED TEMPERATURE TYPE DETECTORS**

##### **GENERAL**

The Heat Sensitive Detectors shall be of the rate of rise cum fixed temperature detection type and shall comply with the requirements of IS 2175 or IS: 2189 or IS: 15908. The detectors shall respond to a rate of rise in temperature of 9-degree C per minute and a fixed temperature of 57-degree C.

##### **CONSTRUCTIONAL FEATURES**

The Heat Detectors shall be of the plug-in type and shall be attached to the mounting plate by a twist and lock motion. The Detector body shall be of molded plastic, white in color. The electrical contacts and other moving parts of the Detector shall be enclosed in such a manner that will afford protection against moisture, dust, insects and other foreign matter

The body and other parts shall be made of material inherently resistant to corrosion.

Any adjustments made at the factory shall be sealed and all adjustment screws shall be provided with a reliable means of locking to avoid disturbance of the adjustments in transit.

##### **MOUNTING PLATES**

All Detectors shall be installed on mounting plates molded from white self-extinguishing thermoplastic. The Detector shall be attached to the mounting plate with a twist and lock motion. The mounting plate shall be suitable for installation on a round recessed box.

##### **DETECTOR OPERATION**

The Detector head shall house a thermostat or a fusible alloy as a fixed temperature element. When activated the external heat collector shall drop to provide a visual confirmation that the fixed temperature element has operated.

A pneumatic element shall sense the rate of rise in temperature by expansion of air within a sealed chamber faster than it can escape through the calibrated vent. The resultant increase in pressure shall depress a diaphragm causing the electrical contacts to close a circuit and trigger an alarm. The rate of rise element shall be of the self-restoring type.

#### **TEST CERTIFICATES**

Test certificate should be provided by Manufacturer.

#### **PORTABLE EMERGENCY TELEPHONE HANDSET JACK**

Portable emergency telephone handset jacks shall be flush mounted on M.S. Plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application

Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.

The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

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#### **THE LIST OF APPROVED MANUFACTURES/MAKES**

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Conventional Fire Control Panel,  
Detectors, Hooters, Response indicators,  
Manual call point, amplifier, speaker etc.

- Bosch  
Daksh Electronics  
Safeway  
Ravel

## 2) FIRE SUPPRESSION SYSTEM

### Section 1. General Instructions

- 1.1 Fire suppression works specified in the tender have to be executed in accordance with:
- 1.1.1 The rules and regulations of Local Fire Authority as per the statutory regulations applicable for obtaining the occupation certificate from the Local Development / Fire Authority.
  - 1.1.2 The contractor has also to ensure compliance of the Rules of the Tariff Advisory Committee (TAC) of the Insurance Association of India, as amended up to date to enable the Project Managers to apply for getting the maximum rebate on insurance premium for the building. Contractor's responsibility for compliance will be only with respect to the items of work put to tender. He will prepare and submit a set of drawings and calculations and such other information as required for making the application. He will also assist the Project Managers in providing all technical clarifications, corrections to drawings and calculations as required by the TAC.
  - 1.1.3 Applicable norms laid down by the National Building Code of Bureau of Indian Standards (B.I.S.) shall be followed as applicable.
  - 1.1.4 The codes of the National Fire Protection Association of USA (N.F.P.A.) shall use as a general guide for good engineering practice, design and workmanship norms. No certificate of compliance to NFPA codes will be required.
- 1.2 All materials used in the works shall have Bureau of Indian Standards valid certification stamped, marked or cast on the material in an acceptable and approved manner.
- 1.3 It is the contractor's responsibility to ensure the competence of design to meet the above requirements.
- 1.4 Drawings issued with the tenders are schematic and indicate the concept. Contractor shall make his shop drawings on basis of Architectural and Interior design drawings issued by the Engineer-in-Charge. Work will be executed only as per approved shop drawings.
- 1.5 Quantities in the tender document are approximate worked out on the tender drawing issued.
- 1.6 Contractors are invited to highlight any aspects of the contract document that may need revision or reconsideration before the work is started. He must furnish a details of any variations in the specifications or the quantities that may be necessary for him to comply with the Code and statutory requirements. These may be identified and approval of the Project managers taken before the start of the work.
- 1.7 Contractors shall furnish detailed Shop drawings, hydraulic and other design calculations for submission and approval of the Local Fire Authority and for Insurance Companies
- 1.8 *It is the sole responsibility of the contractor to get the approval of the Local Fire Authority for the work done by him and nothing extra shall be payable including the official and other charges.*

### 2. System Design

2.1 Fire suppression system for the building is based on the concept of "total protection" by the wet riser hydrant and sprinkler system for the entire premises with excepted areas identified on the drawings or as instructed by the Project Managers.

## **2.2 Water Storage & Pump House**

- 2.2.1 A static underground RCC water storage tank in Two compartment having gross water storage capacity of 200 cum or as per requirement will be provided. The tank will be provided with manholes, inserts, puddle flanges, ladders inside and outside the tanks.
- 2.2.2 One overhead water storage tank 20cum / as per requirement / as per drawing on terrace as a secondary water source for the sprinkler/hydrant system will be provided on the terrace.
- 2.2.3 The pump house is located in the first basement so as to provide net positive suction to all pumps. Test lines from pumps shall discharge back into the fire tank to conserve water.
- 2.2.4 Configuration and operating conditions of pumps are given in the Specifications.

## **2.3. Wet Riser Hydrant System**

- 2.3.1 The building shall be provided with a wet riser system. Hydrants are fed from a 150 mm dia M.S. pipe Heavy Class endless ring main running in setback area or in basement ceiling. The ring main will be provided with three isolation valves to enable at least a part of the main to provide water in case a section is under repairs.
- 2.3.2 External fire hydrants with butterfly isolation valves will be provided on the ring main. Hydrants shall be located at least 2 m away from the building.  
Internal wet risers for the building shall be connected to the ring main with a non return valve and a three-way fire brigade inlet connection with isolation butterfly valve for each wet riser connection.
- 2.3.3 Hydrant stations and cabinets shall be provided at all designated locations inside and along with the external hydrants. The hydrant stations shall be located in a MS steel fire cabinet as per drawings and will contain all items described in the specifications.

## **2.4. Sprinkler System (where specified)**

- 2.4.1 A separate and independent riser fire sprinkler shall be provided as shown on the drawings. The system will be divided in several zones with their own installation valves, located in the basement or near the fire pump room.
- 2.4.2 The entire building is protected with automatic sprinkler system with permitted exceptions e.g. electrical switch rooms, power transformers and D.G. rooms plant rooms as identified.
- 2.4.3 Types of sprinklers to be used shall be as given in specifications, BOQ and approved by the Project Managers

## **2.5. Pumping System**

- 2.5.1 The pumping system shall provide the water supply and pressure to the wet riser fire and sprinkler mains. Diesel Engine will be a common stand by.
- 2.5.2 Provide a full bore test valve on the bypass line with rate of flow meter on the common pump header to discharge in the water tank. Also provide an isolation valve on headers outlet to each circuit to enable pressure setting and testing of pumps.

## **Section 2. Fire Hydrant & Automatic Sprinkler System**

### **2.1 Scope of work**

- 2.1.1 Wet riser fire hydrant system (internal & external)
- 2.1.2 Automatic sprinkler system
- 2.1.3 Fire hydrant & sprinkler pumps.
- 2.1.4 Valves, suction and delivery connections and headers.
- 2.1.5 Hand appliances.
- 2.1.6 Pipe protection, painting, sleeves & minor civil works other than specifically mentioned in the tender.
- 2.1.7 Electrical installations.
- 2.1.8 Specialized protection as specified.
- 2.1.9 Testing and commissioning.

### **2.2. General Requirements**

- 2.2.1 All materials shall be new of the best quality conforming to the specifications and subject to the approval of the Project Managers.
- 2.2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 2.2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 2.2.4 Pipes shall be securely fixed to walls, and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.
- 2.2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

### **2.3 Pipes**

2.3.1 All pipes within and outside the building in exposed locations and shafts including connections buried under floor shall be M.S. Pipes as follows:

2.3.1 Pipes 150 mm dia. and below IS: 1239 Heavy Class

2.3.2 Pipe 200 mm dia. and above IS 3589 of thickness specified.

### **2.4 Pipe Fittings.**

- 2.4.1 Pipes and fittings means tees, elbows, couplings, flanges, reducers etc. And all such connecting devices that are need to complete the piping work in its totality.
- 2.4.2 Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.
- 2.4.3 Forged steel fittings of approved type with "V" groove for welded joints.

- 2.4.4 Fabricated fittings shall not be permitted for pipe diameters 50 mm and below.
- 2.4.5 When used, they shall be fabricated, welded and inspected in workshops under supervision of Project Managers whose welding procedures have been approved by the TAC as per TAC rule 4102 for sprinkler system and applicable to hydrant and sprinkler system. For "T" connections, pipes shall be drilled and reamed. Cutting by gas or electrical welding will not be accepted.

## **2.5 Jointing**

### 2.5.1 Screwed (50 mm dia pipes and below)

Joint for black steel pipes and fittings shall be metal-to-metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall not be welded or caulked.

### 2.5.2 Welded (65 mm dia and above)

Joints between M.S. and pipes and fittings shall be made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. Butt-welded joints are not acceptable. Buried pipes will be subject to X Ray test from an approved agency as per the TAC norms at the cost of contractor.

### 2.5.3 Flanges.

Flanged joints shall be provided on:

- a) Straight runs not exceeding 30 m on pipelines 80 mm dia and above.
- b) Both ends of any fabricated fittings e.g. bends, tees etc. of 65 mm dia or larger diameter.
- c) For jointing all types of valves, appurtenances, pumps, connections With other type of pipes, to water tanks and other places necessary and required as good for engineering practice.
- d) Flanges shall be as per I.S. with appropriate number of G.I. nuts and bolts, 3 mm insertion neoprene gasket complete.

### 2.5.4 Unions

Provide approved type of dismantable unions on pipes lines 65 mm and below in similar places as specified for flanges.

## **2.6 Excavation**

- 2.6.1 Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried to a minimum depth of 1.2 meter or as shown on drawings.
- 2.6.2 Wherever required contractor shall support all trenches or adjoining structures with adequate timber supports.
- 2.6.3 On completion of testing and pipe protection, trenches shall be refilled with excavated earth in 15 cms layers and consolidated.
- 2.6.4 Contractor shall dispose off all surplus earth with in a lead of 200 m or as directed by Project Manager.

## 2.7 Anchor Thrust Blocks

- a) Contractor shall provide suitably designed anchor blocks in cement concrete to encounter excess thrust due to water hammer & high pressure.
- b) Thrust blocks shall be provided at all bends & tees & such other location as determined by the Project Manager.
- c) Exact location, design, size and mix of the concrete block shall be approved by the Project Manager prior to execution of work.

## 2.8 Valves

### 2.8.1 Ball Valves

- a) Valves 40 mm dia & below shall be heavy type nickel plated Brass body screwed type, with chromium plated brass balls, PTFE Teflon seating and gland packing tested to a hydraulic pressure of 20 kg/sq. cm including coupling and gunmetal handle conforming to B.S. 5351 with female screwed ends.
- b) All valves shall be approved by the Project Manager before they are allowed to be used on work.

### 2.8.2 Butterfly Valves

Butterfly Valves shall be cast iron body and shall be of class P.N. 1.6 tested to 20 kg/cm<sup>2</sup> with following details: -

- a) Disc shall be CI heavy duty electrolysis nickel plated abrasion resistant.
- b) The shaft be EN-8 Carbon Steel with low friction nylon bearings.
- c) The seat shall be drop tight constructed by bonding resilient elastomer inside a rigid backing.
- d) Built in flanged rubber seals.
- e) Actuator to level operated for valves above ground and T Key operated for valves below ground.
- f) Built in flanges for screwed on flanged connections.

Manufacturer's details on fixing and installation will be followed.

### 2.8.3 Non Return Valves (NRV)

Where specified non return valve (swing check type) shall be C.I. / MS. Wafer type, suitable for PN-1.6 pressure, EPDM / Nitrile seat, provided through which flow can occur in one direction only. It shall be single door swing check type of best quality.

### 2.8.4 Air Vessel / Air Cushion tank.

- a) Air cushion tank shall be of size and capacity indicated in schedule of quantities. It shall be provided at the top most point/points and/or in pump house (as specified). The tank shall be complete with 20mm dia. Brass Air Valve (Ball type), Stop Valve (20mm dia), Drain valve (20mm dia) and pressure gauge including 20mm dia. Mild Steel Galvanized pipes and fittings, unions, etc. as required to complete the work as per site conditions.

2.8.5 Air Cushion tank shall be measured by numbers and shall include Air Valve, Pressure

Gauge, Globe Valves for testing and draining, M.S. Clamps, Pipes, Fittings, Tees Elbows Union and all other items required to complete the work.

#### 2.8.6 Orifice Flanges

Provide orifice flanges fabricated from 6 mm thick stainless steel plate to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 Kg/sq.cm. and allow a discharge of 560 lap. The contractor shall submit design of the orifice flanges for approval before installation

#### 2.8.7 Drain Valve

Provide 25 mm dia black steel pipe to IS: 1239 (heavy class) with 25 mm Ball valve for draining any water in the system in low pockets.

#### 2.8.8 Inspection & testing assembly

Inspection and testing of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve. The drain pipe beyond the valve up to the drainage point shall be measured with the pipe.

#### 2.8.9. Pump test assembly

Provide on the main fire sprinkler header a 150 mm dia bye pass valve located in an accessible manner along with a rate of flow rotameter calibrated in lap and able to read 200 % of the rated pump capacity. The delivery shall be connected to the fire tank.

#### 2.8.9 Pressure Gauge

Pressure gauge shall be provided near all connections to hydrant system and isolation valves of sprinkler system and where required. Pressure gauge shall be 100 mm dia gunmetal Burden type with gunmetal isolation cock, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate level and height for easy readability.

### 2.9 Hydrant/valve chambers

2.9.1 Contractor shall provide suitable brick masonry chambers (wherever required) in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling complete.

2.9.2 Valve chambers shall be 60x60 cms. for depths up to 100 cms.

### 2.10 Flow switch

a) Flow switches shall be provided on sectional mains and branch lines of sprinkler systems where indicated on drawings, or necessary and required and directed by the Project Manager.

b) Flow switch should be suitable to actuate for opening of a single sprinkler and shall be suitable for connection to a central annunciation panel.

### 2.11 Fire brigade connections

Provide as shown on drawings separate gunmetal 4 way collecting head with four 63 mm instantaneous type inlets with built in check valves and 150 mm dia outlet connected to the fire and sprinkler main. Collecting head shall be installed on a stand post and provided with



horizontal C.I. reflux valve and location to be approved by Project Manager. Provide etched gunmetal label plates with 50mm height letter. The plates should be firmly fixed to the FB connection and any support system.

## **2.12 Fire hydrants**

### **2.12.1 External hydrants**

- a) Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron butterfly valve installed in underground lockable chambers. Hydrants shall have instantaneous type 63 mm dia outlets. The hydrants shall be single outlet conforming to I.S.5290-1969 with C.I duck foot bend and flanged riser of required height to bring the hydrant to correct level above ground.
- b) Contractor shall provide for each external fire hydrant two numbers of 63 mm dia. 15 m long rubberized perm line hose pipe with gunmetal male and female instantaneous type couplings machine wound with G.I. wire (hose to I.S. 8423 and couplings to I.S. 903 with M.S. certification), gunmetal branch pipe with nozzle to I.S. 903.

### **2.12.2 Internal hydrants**

- a) Contractor shall provide on each landing and other locations as shown on the drawings One single headed gunmetal landing valve with 63 mm dia outlet mounted on a common 80 mm inlet (I.S.5290-1969). Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.
- b) Instantaneous outlets for fire hydrants shall be of standard pattern approved and suitable for fire brigade hoses.
- c) Contractor shall provide for each internal fire hydrant station of 63 mm dia. 15 m long rubberized fabric linen hose pipes with gunmetal male and female instantaneous type coupling machine wound with G.I. wire (hose to I.S. 636 Type 2 and couplings to I.S. 903 with I.S. Certification), fire hose reel, gunmetal branch pipe with nozzle I.S. 903 and Fire man's axe.
- d) Each hose box shall be conspicuously painted with the letters "FIRE HOSE".

## **2.13 Fire hose reels**

Contractor shall provide standard fire hose reels with 20 mm dia high pressure rubber hose 36.5 m long with gunmetal nozzle and control valve, shut off valve, all mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall be connected directly to the wet riser. Hose reel shall conform to IS:884-1969 and rubber hose to IS: 5132.

## **2.14 Hose Cabinets**

- 2.14.2 Provide hose cabinets for all internal fire hydrants. Hose cabinets shall be fabricated from 16 gauge M.S. sheet of fully welded construction with hinged double front door partially glazed with locking arrangement, stove enameled fire red paint with "FIRE HOSE" written on it prominently. (Size as given in the Bill of Quantities).

## **2.15 Pipe protection**

- a) All pipes above ground and in exposed locations shall be painted with one coat of zinc chromate primer and two or more coats of synthetic enamel paint of approved shade.
- b) Pipes in chase or buried underground shall be painted with two coats of zinc chromate primer and wrapped with one layer of 4 mm thick PYPCOAT or equivalent

multi-layer sheet as per standard manufacturer's specifications.

## 2.16 Pipe Supports

2.16.1 All pipe clamps and supports shall be galvanized steel. When fabricated from M.S. steel sections, the supports shall be factory galvanized before use at site. Welding of galvanized clamps and supports will not be permitted.

2.16.2 Pipes shall be hung by means of expandable anchor fastener of approved make and design (Dash Fasteners or equivalent). The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamp shall be suitable to carry the weight of water filled pipe and dead load normally accounted.

**Pipe Spacing Table**

		<----- Pipe commercial dia. ----->							
Syno d.	Pipes & Position	15/20	20/25	32/40	50	75/80	100/110	150/160	200
1	<b>Vertical</b>								
1.1	GI /MS	2.4	2.4	3	3.6	4.5	4.5	5.4	5.4
1.2	CI Pipes IS 1729/3989	x	X	<----- 3 m ----->					→
1.3	CI Heavy Duty IS 1536	x	X	<----- 3.6 m ----->					→
1.4	uPVC SWR Systems	x	X	0.5	0.7	0.9	0.9	1.0	
1.5	uPVC Water Supply								
1.6	Polybutylene	<--- As per manufacturer's Recommendations --->							→
1	<b>Horizontal</b>								
1.1	GI /MS	2.0	2.0	2.4	3.0	3.6	4.0	4.5	4.5
1.2	CI Pipes IS 1729/3989			<----- 3 m ----->					
1.3	CI Heavy Duty IS 1536				1.2	3.0	3.6	3.6	4.5
1.4	uPVC SWR Systems				1.2	1.8	1.8	1.8	
1.5	uPVC Water Supply								
1.6	Polybutylene	<----- As per manufacturer's recommendations ----->							

## 2.17. Installation Valve

2.17.1 Installation valves shall be installed on the sprinkler circuits as shown on the drawings.

2.17.2 Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm in all its respects.

2.17.3 Installation valve shall comprise of a 150 mm dia vertical alarm valve complete with 50 mm dia drain and 15mm dia test valve with a provision to install water operated turbine alarm and an electrical alarm bell. A 150 mm dia slim seal butterfly valve shall be provided on up stream of alarm valve, double seated clapper checks valves as alarm valve with pressure gauge and orifice assembly and drain pipe with bye pass on check valve to regulate differential pressure and false alarm, one water operated turbine alarm motor including all accessories necessary and required and as supplied by original

equipment manufacturer and required for full and satisfactory performance of the system.

## 2.18 Sprinkler Heads

- 2.18.1 Sprinkler heads shall be provided at appropriate spacing to cover 9-12 m<sup>2</sup> per sprinkler head in the basements and 12 m<sup>2</sup> per sprinkler on upper floors. The spacing shall however be in conformity with the drawings and properly coordinated with electrical fixtures, ventilation ducts, grills, etc., The **deflector of the sprinkler shall be provided not more than 150 mm from the ceiling**
- 2.18.2 Sprinkler heads shall be quartzite bulb type with a temp. rating of 68deg. C. with gunmetal body fully approved and having current certification of the fire laboratory of the C.B.R.I. Rourke, Underwriter's laboratory (UL) and under the approved certified list of the Fire Office Committee (FOC) of U.K. or NFPA of USA. Any one of the certification as acceptable to the local fire authorities obtained prior to the procurement and approved and accepted by the Project Manager.
- 2.18.2 Sprinkler heads shall be installed in conformity with approved shop drawings and in co-ordination with electrical fixtures, ventilation ducts, cable galleries and other services along the ceiling.

2.18.3 Following type of sprinklers shall be used:

S.No.	Type of Sprinkler	Temp rating
1.	Conventional, Pendant, or Upright	68° C
2.	Special application side wall type with throw suitable for room size of 8 m length (Extended throw type)	68° C
3.	Pendent type (recessed / rosette)	68° C
4.	High temperature (for kitchen)	72° C

- 2.18.4 Spacing and coverage of sprinkler shall be in accordance with risk classification of area in which they are installed, design density and TAC regulation.

## 2.19 Spare Sprinklers

- 2.19.1 Provide a lockable enamel painted steel cabinet including following type of spare sprinklers

a)	Conventional/Pendent type	20
b)	Upright	10
c)	Semi concealed.	0
d)	Sidewall	10

b) The cabinet should also contain one pair of wrenches (of each size of the same are different) for the sprinklers.

c) Spare sprinklers shall be of the same specifications as that of the original sprinklers specified.

## 2.20 Testing

- 2.20.1 All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure or 14 kg/sq.cm (whichever is more) without drop in pressure for at-least 2 hours.
- 2.20.2 Rectify all leakages, make adjustments and retest as required and directed.

## **2.21 Cables**

- 2.21.1 Contractor shall provide control cables from supervisory valves and switches to the annunciation panels.
- 2.21.2 All control cables shall be copper conductor pvc insulated armoured and PVC sheathed 1100 volt grade.
- 2.21.3 All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.
- 2.21.3 All cable joints shall be made in an approved manner as per standard practice.

## **2.22 Cable Trays**

- 2.22.1 All cables shall be routed in approved locations in coordination with all other services in a proper manner.
- 2.22.2 Cable trays shall be of galvanized steel and hung from the ceiling by galvanised rods supported by appropriate size and type of expandable expansion fasteners drilled into the slabs and walls by an electric drill.

## **2.23 Annunciation Panel**

- a) Provide one solid state electronic annunciation panel, fully wired with visual display unit to indicate:
  - b) Flow condition in any flow indicating valve
  - c) The panel should give a visual and audible alarm for any of the above conditions.
  - d) The panel should be standard manufacturer's factory made. All details shall be submitted with the tender.

## **2.24. Measurement**

- 2.24.1 Mild steel pipes shall be measured per linear meter of the finished length and shall include all fittings, flanges, welding, jointing, clamps for fixing to walls or hangers, anchor fasteners, painting and testing complete in all respects.
- 2.24.2 Sluice and full way valves, check valves, installation valves, air valves & flow switches shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications and bill of quantities.
- 2.24.3 Fire hydrants, hose reels, fire brigade connections, orifice flanges shall be measured by number and include all items given in the specifications and bill of quantities.
- 2.24.4 Fire hose and boxes specified shall be measured by number and include all items given in specifications and Bill of Quantities.
- 2.24.5 Fire extinguishers shall be measured by number and shall include full charge.
- 2.24.6 Spare sprinkler cabinets with spare sprinklers specified and spanners shall be measured as per actual item given in the specifications and Bill of Quantities.
- 2.24.7 Sprinkler heads shall be measured by numbers.
- 2.24.8 Cables and cable trays shall be measured per linear meter shall include clamps, hangers, anchor fasteners complete in all respects.

### **Section3 Fire Pumps & Ancillary Equipment**

#### **3.1. Scope of Work**

- 3.1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven pumps as required by the drawings and specified hereinafter or given in the schedule of quantities.
- 3.1.2 Without restricting to the generality of the foregoing, the pumps and ancillary equipment shall include the following:-
- a) Electrically operated and diesel driven pumps with motors, base plates and accessories.
  - b) Alarm system with all accessories wiring and connections
  - c) Pressure gauges with isolation valves & piping, bleed and block valves.
  - d) M.S. pipes, valves, suction strainers, delivery headers & accessories.
  - e) Foundations, vibration eliminator pads and foundation bolts.

#### **3.2 General Requirements**

- 3.2.1 Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.
- 3.2.2 Pumps and motors shall be truly aligned by suitable instruments.
- 3.2.3 All pump connections shall be standard flanged type with appropriate number of bolts. In case of nonstandard flanges companion flanges shall be provided with the pumps.
- 3.2.4 Manufacturer's instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.

Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The Contractor shall provide facilities to the Project Manager or their authorised representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturers works without any cost to the owners.

Each pump shall be provided with a 150 mm dia pressure gauge, isolation cock and connecting piping, bleed and block valve.

Provide vibration eliminating pad and connectors for each pump.

- 3.2.8 The Contractor shall submit with this tender a list of recommended spare parts for two years of normal operation and quote the prices for the same.

#### **3.3 Fire, Sprinkler & Jockey Pumps**

##### **3.3.1 Pumping Sets**

Pumping sets shall be single stage horizontal centrifugal single outlet with cast iron body and bronze dynamically balanced impellers. Connecting shaft shall be stainless steel with bronze sleeve and grease lubricated bearings.

Pumps shall be connected to the drive by means of spacer type love joy couplings

which shall be individually balanced dynamically and statically.

3.3.2 The coupling joining the prime movers with the pump shall be provided with a sheet metal guard.

3.3.3 Pumps shall be provided with approved type of mechanical seals.

3.3.4 Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

3.3.5 The pump shall meet the requirements of the Tariff Advisory Committee and the unit shall be design proven in fire protection services.

### **3.4 Electric drive**

3.4.1 Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.

3.4.2 Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.

3.4.3 Motors shall be wound for class B insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated.

3.4.4 Motors for fire pumps shall meet all requirements and specifications of the Tariff Advisory Committee.

3.4.5 Motors shall be suitable for  $415 \pm 10\%$  volts, 3 phase 50 cycles a/c supply and shall be designed for 40 deg C ambient temperature. Motors shall conform to I.S. 325.

3.4.6 Motors shall be designed for two start system.

3.4.7 Motors shall be capable of handling the required starting torque of the pumps.

3.4.8 Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.

3.4.9 Speed of the motor shall be compatible with the speed of the pump.

### **3.5 Diesel Engine**

3.5.1 Diesel engine shall be of 6 cylinders with individual head assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping, strainer, isolating & pressure reducing valves, bye-pass line complete in all respects.

3.5.2 Engine shall be direct injection type with low noise and exhaust emission levels.

3.5.3 The speed of the engine shall match the pump speed for direct drive.

3.5.4 The engine shall be capable of being started without the use of wicks, cartridge heater, plugs or either at engine room temperature of 7 deg.C. and shall take full load within 15 seconds from the receipt of the signal to start.

3.5.5 The engine shall efficiently operate at 38 deg.C ambient temperature at 50 meters above mean sea level.

- 3.5.6 Noise level of the engine shall not exceed 105 DBA (free field sound pressure) at 3 meters distance.
- 3.5.7 The engine shall be self-starting type up to 4 deg C and shall be provided with one 24 volts heavy duty DC battery, starter, cut-out, battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have a capacity of 180 to 200 ampere hours and 640 amps cold cranking amperage.
- 3.5.8 A battery re-charger of 10 to 15 amperes capacity with trickle and booster charging facility and regulator shall be provided.
- 3.5.9 The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer's design.
- 3.5.10 Engine shall be suitable for running on high speed diesel oil.
- 3.5.11 The system shall be provided with a control panel with push button starting arrangement also and wired to the engine on a differential pressure gauge.
- 3.5.12 The entire system shall be mounted on a common structural base plate with ant vibration mountings and flexible connections on the suction and delivery piping.
- 3.5.13 One Oneself one day oil tank fabricated from 5 mm thick MS sheet electrically welded with a capacity of 8 hours working load but not less than 200 lit shall be provided. Level indicating gauge glass on the day oil tank and low fuel level indication on the control panel shall also be provided.
- 3.5.14 One exhaust pipe with suitable muffler (residential type) to discharge the engine gases to outside open air as per site conditions shall be provided.
- 3.5.15 All other accessories fittings & fixtures necessary and required for a complete operating engine set shall be provided.
- 3.5.16 Contractor shall indicate special requirements, if any, for the ventilation of the pump room.
- 3.5.17 The materials of construction for the major components are as follows:

Casting	: Cast iron
Impeller	: Bronze
Shaft	: EN-8
Wear Rings	: Bronze
Gland Packing	: Graphite Asbestos
Type of Bearing	: Ball bearing/Roll Bearing
Type of coupling	: Flexible couplings

### 3.5.18 Instrumentation

The diesel engine shall be provided with the following instrumentation:

- Temperature indicator in cooling water inlet and outlet
- Temperature indicator in lubricating oil outlet from the oil cooler
- Pressure gauge for lubricating oil system
- Speed indicator
- Lubricating oil sump level indicator
- Fuel oil tank level indicator
- Voltmeter and ammeter in battery charging circuit
- Cooling water high temperature alarm
- Oil pressure low alarm

A local instrument panel shall be provided with the engine for mounting all the above

instruments and annunciation.

3.5.19 Pumps and motor engine shall be mounted on a common base frames fabricated from M.S. structural and placed in suitable concrete foundations with the help of approved cushy foot mountings (Anti-vibration pads) to avoid vibrations. The anti-vibration pads shall be of heavy duty type.

### **3.6 Air Vessel**

3.6.1 Provide one air vessel fabricated from 10 mm M.S. plate with dished ends and suitable supporting legs. Air vessel shall be provided with a 100 mm dia flanged connection from pump, one 25 mm dia drain with valve, one gunmetal water level gauge and 15 mm sockets for pressure switches. The vessel shall be 450 mm dia x 2000 mm high and tested to 20 kg/sq. cm pressure.

3.6.2 The fire pumps shall operate on drop of pressure in the mains as given in para 7 below. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

3.6.3 Operating conditions for fire & sprinkler pumps.

a) Operating pressure 8.0 Kg/sq. cm

### **3.7 Vibration Eliminators**

Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufactures details.

### **3.8 Measurements:**

3.8.1 Fire, sprinkler pumps shall be measured by numbers and shall include all items as given in the specifications and schedule of quantities.

3.8.2 Air vessel, fire alarm, installation valve, sluice valves, non-return valves, vibration eliminators, flanges and suction strainer shall be measured by numbers and shall include all items as given in the schedule of quantities and specifications.

3.8.3 Pump headers, shall be measured per linear meter and shall include all items given in the specifications and schedule of quantities.

## **Section 4 Commissioning and Guarantees**

### **4.1 Scope of work**

Work under this section shall consist of pre-commissioning, commissioning, testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

### **4.2 General requirements:**

4.2.1 The rates quoted in this tender shall be inclusive of the works given in this section.

4.2.2 Contractor shall provide all tools equipment, metering and testing devices required for the purpose.

4.2.3 On award of work, contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and



installed under this contract.

#### 4.3 **Recommissioning**

4.3.1 On completion of the installation of all pumps, piping, valves, pipe connections, and water level controlling devices the contractor shall proceed as follows:-

##### **A Fire protection system:**

- i) Check all hydrant valves and close if any valve is open. Also check that all suction and delivery connections are properly made.
- ii) Test run and check rotation of each motor and correct the same if required.

##### **B Pipe work**

- i) Check all clamps, supports and hangers provided for the pipes.
- ii) Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications. If any leakage is found, rectify the same and retest the pipes.

#### 4.4 **Commissioning & testing**

##### **A. Fire hydrant system**

- i) Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shutoff the pump.
- ii) Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts out at the pre-set pressures. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- iii) Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the pre-set pressure and should not cutout automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However the jockey pump should cut-out as soon as the main pump starts.
- iv) Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- v) When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.
- vi) Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

##### **B. Sprinkler system:**

- i) Start the pump and develop the required pressure in the sprinkler pipes.
- ii) Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler fire alarm should also operate when the test valve is open.

- iii) After satisfactory operation of the pump the contractor shall set up mock fire and test the system.

### **C. Handing over**

- 1) All commissioning and testing shall be done by the contractor to the complete satisfaction of the Project Manager, and the job handed over to the Project Manager, or his authorised representative.
- 2) Contractor shall also hand over, to the Project Manager, all maintenance & operation manuals and all other items as per the terms of the contract.

### **D. Guarantees**

- 1) The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.
- 2) The form of warranty shall be as approved by the Project Manager.
- 3) The warranty shall be valid for a period of one year from the date of commissioning and handing over.
- 4) The warranty shall expressly include replacement of all defective or under capacity equipment. Project Manager may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.
- 5) The warranty shall include replacement of any equipment found to have capacity lesser than the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Project Manager.

## **Section 5 Electrical Installations**

### **5.1 Scope**

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of electric control panels, wiring and earthing of all air conditioning equipment, components and accessories, including supply, installation and wiring of remote control-cum-indicating light panel.

### **5.2 General**

Work shall be carried out in accordance with the Specifications, Local Rules, Indian Electricity Act 1910 as amended up to date, and rules issued thereunder, Regulations of the Fire Insurance Company and relevant BIS Code of Practice.

### **5.3 Wiring System**

All power wiring shall be carried out with 1100 volts grade PVC insulated, armoured, overall PVC sheathed aluminum conductor cables for sizes above 6 sq. mm. Sizes 6 sqmm and below the power wiring shall be of copper conductor only. Cables shall be sized by applying proper derating factor. All control wiring shall be carried out by using 650 volts PVC insulated copper conductor wires in race ways or in conduit. Minimum size of control wiring shall be 1.5 sq.mm PVC insulated copper conductor wires. Minimum size of conductor for power wiring shall be 4 sq.mm 1100 volts grade PVC insulated copper conductor wires in conduit.

### **5.4 Construction Features**

The control panel shall be metal enclosed sheet steel cubicle, indoor type, dead front, floor mounting / wall mounting type. The control panel shall be totally enclosed, and

vermin proof. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. Control panels shall be arranged in multi-tier formation. All doors and covers shall be suitable for double padlocking. All mild steel sheets used in the construction of control panels shall be 14 SWG thick for floor mounted and 16 SWG for wall mounting and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding slag grounded off and welding pits wiped smooth with Plumber metal.

All panels and covers shall be properly fitted and square with the frame and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with hank nuts. Self-threading screws shall not be used in the construction of control panels. Base channel of 75 mm x 75 mm x 5 mm thick shall be provided at the bottom. Minimum clear space of 200 mm between the floor of control panel and bottom most unit (MCB or Bus Bar) shall be provided.

The control panels shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear. Knockout holes of appropriate size and number shall be provided in the control panels in conformity with the location of incoming and outgoing conduits / cables. All equipment such as meters and indicating lamps etc. shall be located adjacent to the unit with which it is associated and care shall be taken to achieve a neat and symmetrical arrangement. Facility shall be provided for termination of cables from top of the control panel. Clamps shall be provided to support the weight of the cables. All power wiring inside the control panel shall be colour coded and control wiring ferruled for easy identification. Circuit diagram showing the arrangement of circuits shall be pasted on the inside of panel door and covered with transparent plastic sheet and all labeling shall be provided in engraved anodized aluminum / bakelite strips on the front face of the panel board.

## **5.5 Circuit Compartment**

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the 'ON' position. Safety interlocks shall be provided to prevent the breaker or contactor from being drawn out when the breaker is in 'ON' position. The door shall not form an integral part of the draw out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

## **5.6 Instrument Accommodation**

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar.

## **5.7 Bus Bars and Bus Bar Connections**

The bus bar and interconnections shall be of aluminum and of rectangular cross sections suitable for full load current for phase bus bars, and half rated current for neutral bus bar and shall be extensible on either side. The bus bars and interconnections shall be insulated with PVC sleeve / tapes and shall be color coded. Alternatively, special insulating paints / materials may be used for the purpose.

All bus bars shall be supported on unbreakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising in case of short circuit in the system. All bus bars shall be provided in separate chamber and properly ventilated. All bus bars connections, in main control panels shall be done by drilling holes with cadmium plated / hot dipped galvanized bolts, nuts and washers.

All bus bars connections in smaller control panels shall be done by drilling hole and connecting by brass bolts and nuts.

All connections between the bus bar and breaker, and between breaker and contactor shall be through copper strips of proper size to carry rated current and shall be insulated with PVC sleeves.

## **5.8 Raceways**

A horizontal race way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

## **5.9 Cable compartments**

Cable compartment of adequate size shall be provided in the control panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate and proper supports shall be provided in cable compartments to support cables.

## **5.10 Indications**

1. 'ON' lamps shall be provided on all outgoing feeders.
2. Cable alley and bus chamber shall be identified on all panels.

## **5.11 Rubber Mat**

Rubber mat shall be provided to cover the full length of front of all panels and rear of panels where back space shall be available for working from the rear.

## **5.12 Materials**

All materials shall be of the best quality complying with the BIS (Bureau of Indian Standards) specifications. Materials used shall be subject to the approval of the Owner's site representative and samples of the same shall be furnished where required.

### **a. Moulded Case Circuit Breaker**

MCCB shall comprise of switching mechanism, contact system, arc extinguishing device and the tripping unit, Contained in a Compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stress.

Switching mechanism shall be of Quick Make- Quick Break type and the trip command shall override all other commands. MCCB shall employ maintenance free contact system to minimize the let thru energies while handling abnormal currents.

The handle position shall give positive indication of 'ON' 'OFF' or tripped.

MCCB shall conform to IS- 2516 (Part I & II/Sec.1) 1985.

### **b. Miniature Circuit Breaker**

Miniature circuit breakers shall be quick make and break type, and shall conform to Relevant Indian Standards. The housing shall be heat resistant and having a high impact strength. The fault current shall not be less than 9 KA at 230 V and shall be BIS approved. MCBs shall be flush mounted and shall be provided with trip free manual operating lever and 'ON' and 'OFF' indications. The contacts shall be provided to quench the arc immediately. MCB shall be provided with magnetic thermal releases for over current and short circuit protection. The over load or short circuit device shall have a common trip bar in the case of D P, TP and TPN miniature circuit breakers.

c. Rotary Switches

Switches up to 60 amps shall be rotary type with compact and robust construction, built up from one or more stacks with contacts and a positioning mechanism with stop as required. Rotary switches shall have HRC fuse fittings of appropriate rating.

d Selector Switch

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

e) Starters

Each motors shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant BIS Codes. All Star Delta and ATS Starters shall be fully automatic.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta / Reduced Voltage Starters. The insulation for contactor coils shall be of class "B".

Operating coils of contactors shall be suitable for 230 / 415  $\pm$  10% volts AC, 50 cycles supply system. The contactors shall drop out when voltage drops to 90% of the rated voltage. The housing of the contactors shall be heat resistant and having high impact strength. Each starter shall have thermal overload protection on all three phases.

f) Over Load Relays

Contactors shall be provided with a three element, positive acting ambient temperature compensated time lagged hand-reset type thermal over load relays with adjustable setting. Hand-reset button shall be flush with the front door for resetting with starter compartment door closed. Relays shall be directly connected for motors up to 35 HP capacity. C.T operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

g) Current Transformers

Current transformers shall be of accuracy class I and suitable VA burden for operation of the connected meters and relays. These shall be resin bonded and epoxy coated.

h) Single Phase Preventers

Single phase preventers shall be provided as per Bill of Quantities and shall be in conformity with relevant BIS Standards. Single phase preventers shall act when the supply voltage drops down to 90% of the rated voltage or on failure of one or more phases.

i) Time Delay Relays

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connections.

j) Indicating Led (22 mm dia) and Metering

All meters and indicating lamps shall be in accordance with BS 37 and BS 39. The meters shall be flush mounted and draw out type. The indicating lamp shall be of LED type. Each main panel shall be provided with voltmeter 0-500 volts with three way

and off selector switch, CT operated ammeter of suitable range with three Nos. CTs of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 amps fuse. Other indicating lamps shall be backed up with fuses as called for.

k.) Toggle Switch

Toggle switches, where called for, shall be in conformity with relevant BIS Codes and shall be of 5 amps rating.

l). Push Button Stations

Push button stations shall be provided for manual starting and stopping of motors / equipment as called for. Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

m) Conduits

Conduits shall be of mild steel and shall be Hard drawn, stove enameled inside and outside with minimum wall thickness of 1.6 mm for conduits up to 32mm diameter and 2 mm wall thickness for conduits above 32 mm diameter. GI pull wires shall be installed in the conduit while laying the conduit.

n) Cables

M.V. cables shall be PVC insulated aluminum conductor and armoured cables conforming to BIS Codes. Cables shall be armoured and suitable for laying in trenches, duct, and on cable trays as required. M.V Cables shall be termite resistant. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

p) Wires

1100 volts grade PVC insulated copper conductor wires in conduit shall be used.

### 5.13 Cable Laying

Cable shall be laid generally in accordance with BIS Code of Practice. Cables shall be laid on 14 gage perforated MS sheet cable trays, and cable drops / risers shall be fixed to ladder type cable trays fabricated out of steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running, proper spacing shall be provided to minimise the loss in current carrying capacity. Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks, tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable. 1.1 KV cable shall be buried 600 mm below ground level.

### 5.14 Wire Sizes

For all single phase / 3 phase wiring, 1100 volts grade PVC insulated copper conductor wires shall be used. The equipment inside plant room and AHU room shall be connected to the control panel by means of insulated aluminum conductor wires of adequate size. An isolator shall be provided near each motor / equipment wherever the motor / equipment is separated from the supply panel through a partition barrier or through ceiling construction. PVC insulated single strand aluminum conductor wires shall be used inside the control panel for connecting different

components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification in control wiring.

The minimum size of control wiring shall be 1.5 sq.mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels.

Power wiring cabling shall be of the following sizes:

- |       |  |  |
|-------|--|--|
| i.    | Upton 5 HP motors/5 KW heaters.                      | 3 x 4 sq.mm copper conductor wires.                      |
| ii.   | From 6 HP to 10 HP motors<br>6 KW to 7.5 KW heaters. | 3 x 6 sq.mm copper conductor wires.                      |
| iii.  | From 12.5 HP to 15 HP motors.                        | 2 Nos. 3 x 6 sq.mm copper conductor wires.               |
| iv.   | From 20 HP to 25 HP motors.                          | 2 Nos. 3 x 10 sq.mm aluminum conductor armoured cables.  |
| v.    | From 30 HP to 35 HP motors.                          | 2 Nos. 3 x 16 sq.mm aluminum conductor armoured cables.  |
| vi.   | From 40 HP to 50 HP motors.                          | 2 Nos. 3 x 25 sq.mm aluminum conductor armoured cables.  |
| vii.  | From 60 HP to 75 HP motors.                          | 2 Nos. 3 x 50 sq.mm aluminum conductor armoured cables.  |
| viii. | 100 HP motors.                                       | 1 No. 3 x 150 sq.mm aluminum conductor armoured cables.  |
| ix.   | 150 HP motor.  | 1 No.3 x 240 sq.mm aluminum conductor armoured cables.   |
| x.    | 250 HP motor.  | 2 Nos. 3 x 240 sq.mm aluminum conductor armoured cables. |
| xi.   | 400 HP motor.  | 3 Nos. 3 x 240 sq.mm aluminum conductor armoured cables. |
| xii.  | 600 HP motor.  | 3Nos. 3 x 400 sq.mm aluminum conductor armoured cables.  |

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The following capacity contactors and overload relays shall be provided for different capacity motors.

TYPE OF STARTER	CONTACTOR CURRENT CAPACITY	OVERLOAD RELAY RANGE
5 HP Motors	D O L	16 amps
7.5HP Motors	D O L	16 amps
10 HP Motors	D O L	32 amps

12.5HP Motors	Star Delta	16 amps	10-16 amps
15 HP Motors	Star Delta	25 amps	10-16 amps
20 HP Motors	Star Delta	32 amps	13-21 amps
25 HP Motors	Star Delta	32 amps	13-21 amps
30 HP Motors	Star Delta	40 amps	20-32 amps
35 HP Motors	Star Delta	40 amps	20-32 amps
40 HP Motors	Star Delta	40 amps	28-42 amps
45 HP Motors	Star Delta	63 amps	28-42 amps
50 HP Motors	Star Delta	63 amps	28-42 amps
60 HP Motors	Auto Transformers/ Reduced Voltage.	125 amps	45-70 amps

75 HP Motors	-do-	125 amps	90-150 amps
100 HP Motors	-do-	200 amps	operated Relay
135 HP Motors	-do-	300 amps	-do-
150 HP Motors	-do-	300 amps	-do-
200 HP Motors	-do-	300 amps	-do-
250 HP Motors	-do-	400 amps	-do-
300 HP Motors	-do-	400 amps	-do-
400 HP Motors	-do-	600 amps	-do-
600 HP Motors.	-do-	900 amps	-do-

### 5.15 Earthing

Earthing shall be copper strips / wires the main panel shall be connected to the main earthing system of the building by means of 2 Nos. 25 mm x 3 mm copper tapes. All single phase metal clad switches and control panels be earthed with minimum 2 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with two numbers distinct and independent copper wires / tapes as follows :

- i. Motors up to and including 10 HP rating. 2 Nos 3 mm dia copper wires.
- ii. Motors 12.5 HP to 40 HP capacity. 2 Nos.4 mm dia copper wires.
- iii. Motors 50 to 75 HP capacity. 2 Nos 6 mm dia copper wires.
- iv. Motors above 75 HP. 2 Nos 25 mm x 3 mm copper tapes.

All switches shall be earthed with two numbers distinct and independent copper wires/tapes as follows:

- i. 3 phase switches and control panels up to 60 amps rating. 2 Nos 3 mm dia copper wires.
- ii. 3 phase switches and control panels 63 amps to 100 amps rating. 2 Nos 4 mm dia copper wires.
- iii. 3 phase switches and control panels 125 amps to 200 amps rating. 2 Nos 6 mm dia copper wires.
- iv. 3 phase switches, control panels, bus ducts, above 200 Amps rating. 2 Nos 3 mm x 25 mm copper tapes.



The earthing connections shall be tapped off from the main earthing of electrical installation. The over-lapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be riveted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance and properly tinned.

#### 5.16 Drawings

Shop drawings for control panels and wiring of equipment showing the route of conduit/cable shall be submitted by the contractor for approval of Project Managers/ Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

#### 5.17 Testing

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS Codes and test report furnished by a qualified and authorised person. The entire electrical installation shall be got approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Supervisor.

#### 5.18 Painting

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be backed in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

#### 5.19 Labels and Tags

Engraved PVC labels shall be provided on all incoming and outgoing feeders switches. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel and covered with transparent plastic sheet. All cables terminations at panels and at equipment's shall be provided with tags as approved by Project Managers.

**5.20** All panels to have provision for padlocking and all MCCB's / MCB's to have provision for locking in off position.

#### 5.21 Measurement of Electrical Control Panels

**Panels shall be counted as** number of units. Quoted rates shall include as lump sum (NOT measurable lengths) for all internal wiring, power wiring and earthing connections from the control panel to the starter and to the motor, control wiring for inter-locking, power and control wiring for automatic and safety controls, and control wiring for remote start/stop as well as indication as per the specifications. The quoted rate for panel shall also include all accessories, switchgear, fuses, contactors, indicating meters and lights as per the specifications.

#### LIST OF APPROVED MAKES

S.NO.	MATERIALS	I.S. No.	BRAND
1	M.S. Pipes up to 150mm Ø M.S. Pipes > 150 mm Ø.	1239 3589	Tata
			Jindal
			SAIL
			Prakash Surya

<u>2</u>	<u>Malleable G.I. Fittings</u>	<u>1879</u>	<u>UNIK</u>
			<u>R Brand</u>
			<u>Zoloto</u>
			<u>DRP</u>
			<u>'C' Brand</u>
<u>3</u>	<u>Forged Steel Fittings (Threaded)</u>		<u>V.S.</u>
			<u>True Forge</u>
			<u>Metline</u>
<u>4</u>	<u>Forged Steel Fittings (Welded)</u>		<u>SUN</u>
<u>5</u>	<u>G.I. Pipe Jointing Material</u>	<u>1879</u>	<u>M-Seal PTFE Tape</u>
			<u>Loctite</u>
<u>6</u>	<u>Welding Rods</u>		<u>Advani</u>
			<u>Esab</u>
			<u>Victor</u>
<u>7</u>	<u>Gate / Full Way Valves and Globe Valves.</u>	<u>778</u>	<u>Leader</u>
			<u>Zoloto</u>
			<u>Sant</u>
<u>8</u>	<u>C.I. Double Flanged Sluice Valves</u>	<u>780</u>	<u>Kirloskar</u>
			<u>IVC</u>
			<u>Leader</u>
<u>9</u>	<u>C.I. Double Flanged Non Return Valves</u>	<u>5312</u>	<u>Kirloskar</u>
			<u>IVC</u>
			<u>Leader</u>
			<u>Zoloto</u>
			<u>Sant</u>
<u>10</u>	<u>Butterfly Valves Wafer Type</u>	<u>13095</u>	<u>Audco</u>
			<u>Advance</u>
			<u>SKS</u>
			<u>Zoloto</u>
<u>11</u>	<u>C.I. Dual Plate Check Valves Slim Type</u>		<u>Advance</u>
			<u>L&amp;T</u>
			<u>SKS</u>
			<u>(Italy)</u>
			<u>Zoloto</u>
<u>12</u>	<u>C.I. Dual Plate Check Valves Slim Type</u>		<u>Advance</u>
			<u>SKS</u>
			<u>(Italy)</u>
			<u>Zoloto</u>
<u>13</u>	<u>Pressure Reducing Valve</u> <u>(Diaphragm/ Piston type)</u>		<u>WATTS</u>
			<u>Honeywell</u>
			<u>OR</u>

			<u>RB</u> <u>(Italy)</u>
			<u>TIEMME</u> <u>(Italy)</u>
			<u>Enolgas (Italy)</u>
			<u>SKS</u> <u>(Italy)</u>
<u>14</u>	<u>Ball Valves</u>		<u>RB</u> <u>(Italy)</u>
			<u>TIEMME</u> <u>(Italy)</u>
			<u>CIM (Italy)</u>
			<u>Enolgas (Italy)</u>
			<u>Zoloto</u>
<u>15</u>	<u>C.I. Suction Strainer</u>	<u>4038</u>	<u>Leader</u>
			<u>Zoloto</u>
			<u>Sant</u>
<u>16</u>	<u>Vibration Eliminator / Bellows</u>		<u>Resistoflex</u>
			<u>Easyflex</u>
<u>17</u>	<u>Fire Hydrant Landing Valve, Hose Boxes, Fire Ho</u> <u>Drum, Branch Pipe, Nozzle etc.,</u>		<u>Newage</u>
			<u>Minimax</u>
			<u>Safex</u>
			<u>Superex</u>
<u>18</u>	<u>Fire Hose Tube</u> <u>(Thermoplast Tubes)</u>	<u>12585</u>	<u>Mitra</u>
			<u>Jyoti</u>
			<u>Suraj</u>
<u>19</u>	<u>RRL Hose Type A</u> <u>(Non Percolating)</u> <u>(Control Percolating)</u>	<u>636</u> <u>8423</u>	<u>Newage</u>
			<u>CRC</u>
			<u>Minimax</u>
			<u>Safex</u>
			<u>Superex</u>
<u>20</u>	<u>Fire Brigade Connector, Draw-out Connector</u> <u>Couplings</u>	<u>903</u>	<u>Newage</u>
			<u>Minimax</u>
			<u>Safex</u>
			<u>Superex</u>
<u>21</u>	<u>Sprinkler Heads</u>		<u>Tyco</u>
			<u>SpraySafe</u>
			<u>Viking (USA)</u>
			<u>HD</u>
			<u>NewAge</u>
			<u>Getech</u>
<u>22</u>	<u>Alarm Valve and Hydraulic Alarm Motor</u>		<u>Tyco</u>
			<u>SpraySafe</u>
			<u>HD</u>
			<u>Viking (USA)</u>
<u>23</u>	<u>Fire Extinguishers</u>		<u>Safex</u>
			<u>Minimax</u>
			<u>Cease Fire</u>
			<u>INTIME</u>
<u>24</u>	<u>Flow Switch</u>		<u>Potter</u> <u>(USA)</u>

			<u>System Sensor</u>
			<u>Indfos</u>
			<u>Danfoss</u>
<u>25</u>	<u>Pressure Switch</u>		<u>Indfos</u>
			<u>Danfoss</u>
<u>26</u>	<u>Pressure Gauge</u>	<u>3624 (CL-I)</u>	<u>H.Guru</u>
			<u>Fiebig</u>
			<u>Tiemme</u>
<u>27</u>	<u>Flow Meter</u>		
<u>28</u>	<u>Horizontal Centrifugal Pumps</u>		<u>Kirloskar</u>
			<u>Crompton Greaves</u>
			<u>Mather + Platt</u>
<u>29</u>	<u>Electric Motors</u>		<u>GE</u>
			<u>Siemens</u>
			<u>Kirloskar</u>
			<u>Crompton Greaves</u>
			<u>ABB</u>
<u>30</u>	<u>Annunciation Panel for Sprinklers</u>		<u>S&amp;W</u>
			<u>Tricolite</u>
			<u>Agni India</u>
			<u>Advance</u>
<u>31</u>	<u>Diesel Engine</u>	<u>10000</u>	<u>Kirloskar</u>
			<u>Ashok Leyland</u>
			<u>Cummins</u>
			<u>Volvo Pentad</u>
<u>32</u>	<u>Battery</u>		<u>Exide</u>
			<u>Prestolite</u>
<u>33</u>	<u>Paint</u>		<u>J&amp;N</u>
			<u>Asian</u>
			<u>Nerolac</u>
			<u>Berger</u>
<u>34</u>	<u>Electrical Switch Gear &amp; Starters</u>		<u>Siemens</u>
			<u>L&amp;T</u>
<u>35</u>	<u>Cables</u>		<u>Skytone</u>
			<u>CCF</u>
			<u>Coloster</u>
			<u>Nitco</u>
<u>36</u>	<u>Single Phase Preventer</u>		<u>L&amp;T</u>
			<u>Siemens</u>
			<u>Minilec</u>
<u>37</u>	<u>Main Control Panel</u>		<u>Trintron</u>
			<u>Advance</u>
			<u>Tricolite</u>
			<u>Vidut Control</u>
<u>38</u>	<u>Contactor</u>		<u>L&amp;T</u>
			<u>Siemens</u>
			<u>GE</u>
<u>39</u>	<u>Thimbles / Ferrules</u>		<u>Dowel</u>
<u>40</u>	<u>Cable Glands</u>		<u>Comex</u>
			<u>Power</u>
			<u>Gripwell</u>
<u>41</u>	<u>Power Capacitor</u>		<u>L&amp;T</u>
			<u>Crompton Greaves</u>

			Asian
42	Measuring Meter		L&T
			Siemens
			Rishab
43	M.S. Conduit		Steel Craft
			BEC
			AKG
44	Pipe Coat Material		PYPKOTE
45	Fire Sealent and Dash Fasteners		Hilti
			Fisher

### 3) HVAC WORKS

#### LIST OF INDIAN STANDARDS (IS)

Latest edition of following standards shall be referred

	Colours for ready mixed paint and enamels
IS 5:1994	
IS: 325	Three phase induction motors
IS: 374	Ceiling fans and regulators (3rd revision)
IS: 398 (Part-I)	Aluminium stranded conductors
IS: 398 (Part-II)	Aluminium conductors, galvanized steel reinforced
IS: 694	PVC insulated Electric cable for working voltage upto and including 1100 volts.
IS: 732	Code of practice for electrical wiring and installation
IS: 900	Code of practice for installation and maintenance of induction motors
IS: 1248	For measuring instruments
IS: 1255	Code of Practice for installation and maintenance of Power Cables upto and including 33 kV rating (Second Revision).
IS: 1258	Bayonetlamp holders(Third revision)
IS: 1293	Three pin plugs and sockets outlets rated voltage up to and including 250 volts and rated current upto and including 160 amps.
IS: 1554 (Part-I)	PVC insulated (Heavy Duty) electric cables for working voltages upto and including 1100 volts.
IS: 1554(Part-II)	PVC insulated (Heavy Duty) electric cables for working voltages from 3.3 kV to 11 kV.
IS: 1646	Electrical installation fire safety of buildings (general) Code of practice.
IS: 1651 & 1652	Stationary cell & batteries, lead acid type.
IS: 1885	Glossary of items for electrical cables and conductors
IS: 1913	General and safety requirements for fluorescent lamps luminaries Tubular.
IS: 1944 (Part-I & II)	Code of practice for lighting of public through fares
IS: 2026 - 1977 to 81 (Part I to IV)	Power Transformers
IS: 2071 (Part-I to III)	Methods of high voltage testing
IS: 2147	Degree of protection provided by enclosures for low voltage switchgears and control gears
IS: 2148	Double compression cable glands
IS: 2208 & IS: 9224 (Part – I & II) (IEC: 269)	Cartridge fuses for voltages upto and including 650 V.
IS: 2268	Electric call bell and buzzers
IS: 2309	Protection of building and allied structures against lightning
IS: 2418	Tabular fluorescent lamps for general lighting service
IS: 2440	Guide for day lighting of building
IS: 2544	Porcelain post insulators for systems with nominal voltages greater than 1000 volts.
IS: 2551-1982	Danger notice plate.
IS: 2667	Fittings rigid steel conduits for electrical wiring
IS 2705 (Part-1) : (Second Rev.)1992	Current transformers - Specification General requirements
IS 2705 (Part-2) : (Second Rev.)1992	Current transformers - Specification Measuring Current Transformers
IS 2705 (Part-3) : (Second Rev.)1992	Current transformers - Specification Protective Current Transformers
IS 2705 (Part-4): (Second Rev.) 1992	Current transformers - Specification Protective Current Transformers for Special Purpose Applications
IS: 3043	Code of practice for earthing.

IS: 3070	Lightning arrester for alternating current system
IS: 3156	Potential transformer
IS: 3419	Fittings for rigid non-metallic conduits
IS: 3427	AC Metal enclosed switch gear and control gear for rated voltages above 1 KV and upto and including 52 KV.
IS: 3480	Flexible steel conduits for electrical wiring.
IS: 3639	Fittings and accessories for power transformers
IS: 3837	Accessories for rigid steel conduit for electrical wiring.
IS: 3854	Switches for domestic and similar purpose
IS: 3961	Current ratings for cables
IS: 4004	Application guide for surge arrestors for AC system
IS: 4012	Specifications for dust proof electric light fittings
IS: 4013	Specifications for dust tight electric light fittings
IS: 4146	Application guide for voltage transformers
IS: 4160	Interlocking switch socket outlets
IS: 4201: 1983	Application guide for current transformers
IS: 4257 Part1: 1981	Dimensions for clamping arrangement for bushings 12KV to 36KV
IS: 5039	Specifications for distribution pillars upto 1100 volt AC
IS: 5133(Part -I)	Boxes for the enclosure of electrical accessories.
IS: 5216(Part-I& II)	Guide for safety procedures and practices in electrical work.
IS: 5424	Rubber mats for electrical purposes.
IS: 5578 & 11353	Marking and arrangement of bus bars
IS: 5819	Guide for short circuit rating of high voltage PVC cables
IS: 5987	Code of practice for selection of switches
IS: 6600: 1972	Guide for loading of oil immersed transformers
IS: 7098 - (Part - II)	Cross linked polyethylene insulated PVC sheathed cables. For working voltages from 3.3 KV upto and including 33 KV
IS: 8130	Conductors for insulated electric cables and flexible cords
IS: 8468: 1977	On-load tap changers
IS: 8478: 1978	Application guide for on-load tap changers
IS: 8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V D C.
(Part -I, II & III)	Miniature Circuit Breakers
IS: 8828	Fuses for protection of semiconductors
IS: 9224 (Part - IV)	HV HRC Control Fuse
IS: 9385	Selection, installation and maintenance of switchgear and control gear
IS: 10118	Luminaries – method of tests
(Part-I, II, III & IV)	Particular requirement – General purpose luminaries
IS: 10322 (Part-IV)	
IS: 10322	
(Part-V/ Sec-1)	
IS: 10810	Methods of test for cables.
IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS: 12360	Voltage bands for electrical installation including preferred voltages and frequency
IS: 12640	Earth Leakage Circuit Breakers
IS: 12729	Switchgear and control gear for voltage exceeding 1000 volts
IS: 12943	Single compression cable gland
IS: 13021(Part-I)	Electronic ballasts for fluorescent lamps – General & safety requirements
IS: 13021(Part-II)	Electronic ballasts for fluorescent lamps – Performance requirements
IS: 13021(Part-III)	Luminaries – Screw and screw less termination
IS : 13118 :1991	Specification for high voltage alternating current circuit breaker
IS: 13703	Low voltage fuses upto 1000 volts
IS: 13947	Degree of protection provided by enclosures for LV switchgear and control gear.
IS: 13947	General requirement for switchgear and control gear for

	voltage not exceeding 1000 Volts.
IS: 15652	Insulating mats for electrical purposes.
IS: 1651 & 1652	Stationary cells and batteries lead acid type.
IEEE: 32	Standard requirements, terminologies, test procedures for neutral grounding resistors
IEEE: 241	Recommended practice for power systems in commercial buildings
IEEE: 446-1987	Recommended practices for emergency & standby power systems
IEEE: 450-1975	Recommended practices for maintenance, testing of lead acid batteries
IEEE: 472	Practices and requirements for surge withstand capability test.
IEEE: 519 – 1992	Practices and requirements for harmonic control in electrical power systems
IEEE: 1100	Practice and requirements for powering and grounding electronic equipment
IEC	Semiconductor convertor standards
IEC: 60140-1	Safety
IEC: 60140-2	Electro Magnetic Compatibility
IEC: 60140-3	UPS performance
CBIP	Manual on Transformers
BS: 2709 (IEC: 119)	Recommended practices for electrical performance of Semiconductor Rectifiers (Metal Rectifiers)
BS: 4417 (IEC: 146)	Recommended practices for Semiconductor Rectifier equipment
BS: 9720	Recommended practice for custom built transformer and inductors of assessed quality
ANSI: C 34.2	Practices and requirements for semiconductor power rectifiers
ANSI: C 37.90	Relay and relay system associated with electrical power apparatus
NEMA PE-1 1983	Uninterrupted Power System Standards

## **ABBREVIATIONS**

The following abbreviations have been used in the accompanying Specifications, drawings and Schedule of Quantities.

CU Stands for copper.

GI Stands for Galvanized Iron (Mild Steel)

V Stands for Volts

KV Stands for Kilo Volts

HV Stands for High Voltage (3.3 KV and above)

MV Stands for Medium Voltage (110 V, 230 V, 415 V, 600 V, 110 V)

LV Stands for Low Voltage (32 V & Below)

HT Stands for High Tension

LT Stands for Low Tension

PVC Stands for Polyvinyl Chloride

AMP Stands for Amperes

KWH Stands for Kilowatt Hours

KW Stands for Kilo Watts

BIS Stands for Bureau of Indian Standards

IS Stands for Indian Standards

IEC Stands for International Electro technical Commission

IEE Stands for Institution of Electrical Engineers - London

IEEE Stands for Institution of Electrical & Electronics Engineers

NEC Stands for National Electrical Code

ACB Stands for Air Circuit Breaker

RCCB Stands for Residual Current Circuit Breaker

MCB Stands for Miniature Circuit Breaker

MCCB Stands for Moulded Case Circuit Breaker

SP Stands for Single Pole

DP Stands for Double Pole

TP Stands for Triple Pole



TPN Stands for Triple Pole and Neutral  
4 Pole Stands for 3 phase and neutral of same capacity (size)  
MDB Stands for Main Distribution Board  
SDB Stands for Sub Distribution Board  
FDB Stands for Final Distribution Board  
MCC Stands for Motor Control Centre

## TECHNICAL SPECIFICATIONS

### 1(A) DISTRIBUTION PANELS/ BOARDS

Main Distribution Panels, Sub-Distribution Panels and Final Distribution shall be covered under this section. Panels/ Boards shall be suitable for operation on 3 Phase/ single phase, 415/ 240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by an approved manufacturer. **CPRI certificate shall be made available.**

Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

#### 1.1 Construction Features

Distribution panels shall be 2 mm thick sheet steel cabinet for indoor installation, dead front, floor mounting/ wall mounting type and shall be form 3b construction. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back. All removable/ hinged doors and covers shall be grounded by flexible standard connectors. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of Distribution panels shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall conform to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self-threading screws shall not be used in the construction of Distribution panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum **operating** clearance of 275mm shall be provided between the floor of Distribution panels and the lowest operating height.

Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Feeders shall be arranged in multi-tier. Knock out holes of appropriate size and number shall be provided in the Distribution panel in conformity with the location of cable/ conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal nameplates. All panels shall be provided with circuit diagram engraved on PVC sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm. The minimum thickness of power coating shall be 60 min.

#### 1.2 Bus Bar Connections

Bus bar and interconnections shall be of high conductivity electrolytic grade aluminium/ copper as indicated in the bill of quantities complying with requirement of IS: 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fibre reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system.

All bus bars shall be provided in a separate chamber and all connections shall be done by bolting.

Additional cross sectional area to be added to the bus bar to compensate for the holes. All connections between bus bars and breakers shall be through solid copper/ aluminium strips of proper size to carry full rated current and insulated with insulating sleeves. Maximum current density for the bus bars shall be 0.8 A/ sq. mm for aluminium and **1.4** A/ sq. mm for copper bus bars.

Maximum allowable temperature for the Bus bar to be restricted to 85 deg C. The temperature rise limits of other current & non-current carrying parts shall be as per IS 8623/IEC60419

#### 1.2.1 Temperature - Rise Limit

Unless otherwise specified, in the case of external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1993.

All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram. All final Distribution boards shall be provided with Miniature Circuit Breakers. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover. All Distribution boards shall be completely factory wired, ready for connection. All the terminals shall be of proper current rating and sized to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

### 1.3 Cable Compartments

Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/ bottom. Adequate supports shall be provided in cable compartment to support cables.

### 1.4 Air Circuit Breakers (ACB)

1.4.1 The ACB shall conform to the requirements of IS/IEC 60947-2 and shall be type tested & certified for compliance to standards from CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 415 V + 10%, 50 Hz supply system. Air Circuit Breakers shall be with moulded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" indications. Manufacture shall submit test reports for combine sequence tests as per IS/IEC.

The ACB shall be 3/ 4 pole with modular construction, draw out, manually or electrically operated version as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity(Icu) and short circuit withstand values(Icw) for 1 sec i.e.  $I_{cs}=I_{cu}=I_{cw}$  for 1 sec.

Circuit breakers shall be designed to 'close' and 'trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Inspection of main contacts should be possible without using any tools. The ACB shall be provided with a door interlock. i. e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

Main current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breakers shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/ OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open. Minimum 4 NO and 4 NC auxiliary contacts shall be provided on each breaker.

Rated insulation voltage shall be 1000 volts AC. Rated Impulse-12KV for main circuit. All 4 pole ACB's shall have 100% rated neutral pole.

#### 1.4.2 Cradle

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls/ rollers and not on flat surfaces.

There shall be 3 distinct and separate position of the circuit breaker on the cradle.

Racking Interlock in Connected/ Test/ Disconnected Position.

Service Position: Main Isolating contacts and control contacts of the breaker are engaged.

Test Position: Main Isolating contacts are isolated but control contacts are still engaged.

Isolated Position: Both main isolating and control contacts are isolated.

There shall be provision for locking the breaker in any or all of the first three positions.

The following safety features shall be incorporated:

a. Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.

b. Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.

c. All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.

d. All Switchgear module front covers shall have provision for locking.

e. Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.

#### 1.4.3 Protections

The breaker should be equipped with micro-controller based, to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones:

- Long time protection with adjustable time delay.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection and adjustable time delay.

The protection release shall generally have following features and settings however for exact requirement of protection releases, reference shall be made to SOQ:

##### a. True RMS Sensing

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current. It shall take into account the effect of harmonics also.

##### b. Thermal Memory

When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic Hot/ Cold curves shall take into account the integrated heating effects to offer closer protection to the system.

##### c. Defined time-current characteristics:

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

##### d. Trip Indication

Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis.

##### e. Self-powered

The release shall draw its power from the main breaker CTs and shall require no external power supply for its operation.

- e. The release shall meet the EMI/ EMC requirements.

Long Time	0.4 to 1.0 times in (Ir)	0.5 to 30 sec at 6 Ir
	Steps: 0.4, 0.5, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00.	Steps 0.5, 1, 2, 4, 6, 8, 12, 18, 24 and 30 secs
	Operating Limit: 1.05 to	Tolerance: Corresponding to ±10% of current.

1. 2 times  $I_r$

Short Time	2 to 10 times $I_r$ Steps: 2, 3, 4, 5, 6, 7, 8, 9 & 10 Tolerance: $\pm 10\%$	20 ms to 400 ms Steps 20, 60, 100, 160, 200, 260, 300 400ms Tolerance: $\pm 10\%$ or 20ms whichever is higher
Instantaneous	2 to 12 times $I_n$ Steps: 2, 3, 4, 6, 8, 10, 12 Tolerance: $\pm 10\%$	
Ground Fault	0. 2 to 0. 6 time $I_n$ Steps: 0. 2, 0. 3, 0. 4, 0. 5, 0. 6 Tolerance: $\pm 10\%$	100 ms to 400 ms Steps: 100, 200, 300, 400ms Tolerance: +10% or 20 ms whichever is higher.

All **incomer** ACBs(DG, Transformer) shall have following additional protections other than mentioned above.

- Under and over voltage
- Under and over frequency
- Trip Circuit supervision
- Undercurrent, (for DG set only)
- Reverse power (for DG set only)
- Phase sequence reversal
- Restricted earth fault with PS class CT's.
- Temp. rise protection and display through release.

The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have LED/ LCD for display of power parameters. The release of incoming breakers should provide comprehensive metering with the following parameters

- Phase currents (running, avg & max) – All parameters in single window.
- Release should be able to capture short circuit current on which ACB has tripped. The last five trips and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm. The sensing CT should be Rogowsky type with measurement precision of 1%.
- Release should have facility to select different type of IDMTL protection (DT, SIT, VIT, EIT, HVF) for better co-ordination with HT Breaker/ Fuse.
- Phase voltages (running, avg & max)
- Energy & power parameters (active, reactive and apparent)
- PF
- Frequency
- Maximum Demand (KVA & KW)

All **O/ G and APFC** ACBs shall have following functions.

#### **Protection**

- The ACB control unit shall offer the following protection functions as standard:
- Long-time (LT) protection with an adjustable current setting and time delay;
- Short-time (ST) protection with an adjustable pick-up and time delay; instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
- Current and time delay setting shall be indicated in amperes and seconds respectively on a digital display.
- Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

## Measurements

- An ammeter with a digital display shall indicate the true rms values of the currents for each phase. Release shall acknowledge the current & time delay settings done by user on the LCD/led display.
- The release shall actual percent loading at any instant.

### 1.4.4 Safety Features

- i. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
- ii. It shall not be possible to interchange two circuit breakers of two different thermal ratings. For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle.
- iii. There shall be provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB.
- iv. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.
- v. It shall be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.
- vi. Draw out breakers should not close unless in distinct Service/ Test/ Isolated positions.
- vii. The insulation material used shall conform to Glow wire test as per IEC60695.
- viii. The ACB shall provide in built electrical and mechanical anti-pumping.
- ix. All EDO ACB's Shall have Ready to Close Contact to ensure that the ACB gets a command only when it is ready to close for applications of Remote Control, AMF, Synchronization and Auto Source Change Over Systems.

## 1.5 Moulded Case Circuit Breaker (MCCB)

The MCCB should be current limiting type with trip time of less than 10 m sec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS/ IEC 13947 – Part 2 and should have test certificates for Breaking capacities from independent test authorities CPRI/ ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC – 60947-2, 1989/ IS: 13947- 2. The breaker as supplied with ROM should meet IP54 degree of protection.

### 1.5.1 Current Limiting & Coordination

- The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. **The manufacturer shall provide both the discrimination tables for all circuit breakers.**

### 1.5.2 Protection Functions

- MCCBs with ratings up to 200 A shall be equipped with Thermal-magnetic (adjustable thermal for overload and fixed magnetic for short-circuit protection) trip units.
- Microprocessor MCCBs with ratings 250A and above shall have adjustable overload, adjustable S/C and inbuilt earth fault protection.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings.

- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility etc.)
- All Microprocessor components shall withstand temperatures up to 105 °C.
- Protection settings shall apply to all poles of circuit breaker.

### 1.5.3 Testing

- a) Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- b) Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

### 1.5.4 Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- a) Handle interlock to prevent unnecessary manipulations of the breaker.
- a) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) Defeat-interlocking device to open the door even if the breaker is in ON position.
  - All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
  - The trip command shall override all other commands.
  - All MCCb's above 63A should be provided with silver plated cu. Spreader terminals

## 1.6 Motor Protection Circuit Breaker (MPCB)

Motor circuit breakers shall conform to the general recommendations of standard IEC 947 -1, 2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°14.

The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947-4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard voltage 415V, IEC 60947-2 and shall have a rated impulse withstand voltage (Uimp) of 6 kV.

The motor circuit breakers shall be designed to be mounted vertically or horizontally without derating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc. by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the "isolated" position.

The motor circuit breakers shall be equipped with a "PUSH TO TRIP" device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC.

All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly coordinated motor-starter.

This combination shall enable type 1 or type 2 co-ordinations of the protective devices conforming to IEC 60947-4-1. Type 2 co-ordination shall be guaranteed by tables tested and certified by an independent test lab. The motor circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set between 12-14 I<sub>r</sub>

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 55°C without derating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available.

### **1. 7 Miniature Circuit Breaker (MCB)**

Miniature Circuit Breaker shall comply with IS-8828-1996/ IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/ 415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B, C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/ IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF. The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

### **1. 8 Residual Current Circuit Breaker Current Operated Type (RCCB)**

#### **1.8.1 System of Operation**

Residual Current Circuit Breaker shall conform to IEC 61008. RCCB shall work on the principle of core balance transformer. The incoming shall pass through the toroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electromotive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 mA/100mA at 240/ 415 volts AC as per SOQ and shall have a minimum of 10, 000 electrical operations.

#### **1.8.2 Mechanical Operation**

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing/ opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

#### **1.8.3 Neutral Advance Feature**

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact first before the phases; and at the time of opening, the neutral shall break last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

#### **1.8.4 Testing Provision**

At least device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB/ RCCB and the operating handle shall move to the "OFF" position.

### **1.9 Earthing**

Earthing shall be provided as per IS: 3043-1987.

### **1.10 Painting**

All sheet steelwork shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/ outside shall be as per BOQ confirming to IS Code No. 5.

### **1.11 Labels**

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

### **1.12 Meters**

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be flush type.
- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

### **1.13 Current Transformers**

Current transformers shall be provided for Distribution panels. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary's for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

### **1.14 Potential Free Contacts**

Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

### **1.15 Indicating Panel**

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/ MPCB as per relevant fault level and toggle switch.

### **1.16 Testing**

Testing of panels shall be as per following codes:

- a. IS: 8623 (Part -I) 1977 for factory built assemblies of switchgear for voltages upto and including 1000 VAC.
- b. Degree of protection.
- c. IS: 5578 & 11353: 1985 Arrangement of bus bars.

### **1.17 Wiring**

In wiring a distribution panel it shall be insured that total load of various distribution panel and/ or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing. All power and control wiring shall be FRLS.

#### **1.10 Anti-Condensation Space Heaters**

1 No. 100 W, 240 volts, single phase, 50 Hz AC Anti Condensation space heaters controlled by humidistat and protected by 6 amps MCB's or MPCB's as per fault level at the panel shall be provided in each vertical section of main LT panel and 1 No. 60 watt Anti Condensation space heater with humidistat shall be provided in each cable alley of main distribution boards and sub distribution boards.

### **1.19 Installation**

Installation of all LT panels shall include but not limited to the following to complete the installation, testing and commissioning:

- a) Transporting materials from stores to exact location of installation.
- b) Supply and installation of required base frame made of MS angle or channel sections and duly painted with black paint.
- c) Positioning, aligning, fixing, assembling, and installation of LT panel issued free of cost by Client after carrying out proper cleaning and inspection.
- d) Site supervision, testing for proper functioning/ operation, and pre-commissioning tests.

### **1.20 Commissioning and Onsite Testing**

- a) All switchboards shall be tested for dielectric test with 1000V meter.
- b) All earth connections shall be checked for continuity.
- c) All bus bar connections shall be checked and tightened properly.
- d) All cable terminations and terminal shrouding shall be checked if they are properly done.
- e) The operation of protective devices shall be tested by secondary injection test.
- f) The operation of circuit breaker shall be tested for all interlocks.
- g) Functional test shall be done for all ACBs, MCCBs and other components.
- h) Indicating lamps and meters shall be checked for proper working.

### **2(B) FINAL DISTRIBUTION BOARDS (FDB's)**

Final Distribution Boards (FDBs) shall be suitable for operation on 3 Phase/ single phase, 415/ 240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum di-electric strength of 2.5 kV/ Sec. All Distribution Boards shall manufactured by a manufacturer listed in Appendix-II.



FDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-60947-1993.

## **2.1 Construction Features**

TPN DB's shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of FDB shall be folded and braced as necessary to provide a rigid support for all component. FDB shall be suitable for indoor/ outdoor installation, wall mounting free standing type, in double door construction. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sq.m tinned stranded copper connectors. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall conform to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self-threading screws shall not be used in the construction of FDBs.

Knock out holes of appropriate size and number shall be provided in the FDB's in conformity with the location of cable/ conduit connections. Detachable sheet steel gland plates shall be provided at the top/ bottom to make holes for additional cable entry at site if required.

Final Distribution Boards shall comprise of the following:

2.1.1 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

2.1.2 Installation accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc. neutral bus bars & earthing bus bars required in the circuit. All bus bars in the FDB shall be insulated type.

2.1.3 Service cable/ interconnection shall be part of the Distribution Boards.

2.1.4 The board shall be installed at a height such that the operating is within reach of the normal human height i. e. 1.2 to 1.8 meters from finish floor level.

2.1.5 Degree of protection shall be IP-42 for indoor application and IP-55 for outdoor application.

2.1.6 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.

2.1.7 Seven Segment DB's.

2.1.8 Earthing shall be provided in each FDB's.

2.1.9 All TPN DB's having RCCB at phase incomer load ,shall have separate neutral & earth bus.

## **2.2 Miniature Circuit Breaker (MCB)**

For specifications refer Section 4A, clause 4.7

## **2.3 Residual Current Circuit Breaker Current Operated Type (RCCB)**

For specifications refer Section 4A, clause 4.8

## **2.4 Earthing**

Earthing shall be provided as per IS: 3043-1987.

## **2.5 Painting**

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/ outside shall be of Siemens grey paint shade no. RAL-7032 of IS Code No. 5.

## **2.6 Labels**

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

## **2.7 Testing**

Testing of panels shall be as per following codes:

i. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.

ii. IS: 13947: 1993 Degree of protection

## **2.8 Wiring**

In wiring a distribution panel it shall be insured that total load of various distribution panel and/ or consuming devices is divided evenly between the phases and number of ways as per drawing.

## **3. POWER FACTOR CORRECTION SYSTEM**

### **3.1 Scope**

Design, manufacture, supply, erection, testing and commissioning of Indoor type power correction capacitor banks for power factor improvement as per specification given below:

### **3.2 Standard**

Unless otherwise stated below, the capacitor shall comply with the following standards (and their latest amendments): IS 13340-1993, IS 13341-1992, IEC 60831-1+2

### **3.3 Rating**

50 kVAr/ 25 kVAr/ 12.5 kVAr capacitor units as specified in the BOQ shall be used to form a bank of capacitors of desired capacity.

### **3.4 Enclosure**

The panel shall be indoor type, free standing, and floor mounting with IP42 degree of protection. It shall be completely made of CRCA sheet steel. The enclosure shall have sturdy support structure with angle supports as necessary and shall be finished with powder coating in the approved colour shade/ s to match the colour of the other panels. The thickness of powder coating should be minimum 60-80 microns.

Suitable provisions shall be made in the panel for proper heat dissipation. Air aspiration louvers for heat dissipation shall be provided as a necessary.

The front portion shall house the switchgear and the rear portion shall house capacitors and series reactors. The enclosure is to be suitably sized to accommodate all the components, providing necessary air clearance between live and non-live parts, providing necessary working clearance.

### **3.5 APFC Relay/ Controller**

Microprocessor based APFC relay (Intelligent VAr controller) shall sense the PF in the system and automatically switch ON/ OFF the capacitor unit or stage to achieve the preset target PF. The controller shall have the following features:

- Digital settings of parameters like PF, Switching time delay, Step limit etc.
- Indication of PF, preset parameters.
- Minimum threshold setting of 2.5% of CT current.
- No-volt release.
- Protection/indication in case of harmonic overload.
- Indication for Failure to achieve the target PF, Harmonic overloading, Step failure etc.

### **3.6 Capacitor Unit**

Each basic unit of Metalized Poly Propylene (MPP)/Heavy Duty capacitor shall be built with a number of elements. These elements shall be biaxially oriented polypropylene film impregnated with non PCB bio-degradable impregnant or Film Foil capacitor manufactured using Poly propylene film placed between 2 layers of metal foil and winding. The elements shall be connected to the external bus bars through these leads in a series parallel connection to form a three phase unit.

The capacitor units shall be floor mounting type using minimum floor space. The container of capacitors shall be made out of 2 mm thick M S sheet steel of polyester paint coated finish. Each standard unit shall be provided with internal fuses (operation coordinated with case-rupture characteristics to avoid rusting).

Total Harmonic Distortion (THD) of up to 5% on voltage and current waveforms shall not affect the life of capacitors.

### 3.7 Capacitors

- General specifications: 3 phase, delta connected, 50 Hz.
- Voltage: Shall be designed for minimum 480V/525V and shall withstand system over voltage, increased voltage due to series reactor and harmonics. Capacitors shall be rated for 480V/525V when used in series with 7%/14% reactor.
- Capacitor type: Super heavy duty with double side metalized capacitor tissue paper. Oil impregnated and self-healing type with bi-axially oriented polypropylene film shall be fitted with pressure sensitive disconnecter in each individual capacitor cell.
- Overvoltage +10% (12h/ 24h), + 15% (30m/ 24h), + 20% (5m), +30% (1m) as per Clause 6.1 of IS 13340-1993.
- Over current: 1.8x In
- Peak Inrush current withstand: 250 x In
- Total watt-losses including discharge resistors: < 0.45 W/ kVAr.
- Temperature category: -25 deg. C to 55 deg. C.
- Capacitor shall be self-heating type and oil impregnated for longer life. The impregnant shall be non-PCB, biodegradable type, must be properly treated and de-gasified, so as not to have any degeneration properties and shall be non-oxidizing.
- The design shall be modular for simple mechanical assembly, no extra accessories/ metal parts to be required. Unit must be free standing with an IP 41 protection level.

### 3.8 Discharge Resistance

Capacitors shall be provided with permanently connected discharge resistors so that residual voltage of capacitors is reduced to 50 volts or less within one minute after the capacitors are disconnected from the source of supply.

### 3.9 Terminals

Each capacitor bank shall be provided with a terminal chamber and cable glands suitable for PVC insulated aluminum conductor armoured cables as specified.

### 3.10 Earthing:

Two separate earthing terminals shall be provided for earth connection of each bank.

### 3.11 Testing

The reactor shall be tested using a separate source voltage test of 3 KV (coil to core) for one minute as per IEC 76/ 3. The reactor shall be fitted with a temperature sensitive micro-switch in the centre coil (normally open) for connection to trip circuit in case of high operating temperature. 7 % or 14 %

Copper wound reactors shall be provided in series with capacitor banks

### 3.12 Switchgear & Protection

Incomer switchgear shall be TP&N breaker appropriate rating (**minimum 1.8 times** the normal current to take care of inrush switching current). Suitable contactor for each step shall be used and must be capable of capacitor switching duty at each step for short circuit protection.

Bus bars shall be suitably colour coded and must be mounted on appropriate insulator supports.

Power cables used shall have superior mechanical, electrical and thermal properties, and shall have the capability to continuously operate at very high temperatures up to 125 deg. C.

Internal wiring between main bus-bars, breaker, contactor and capacitors shall be made with 1100 V grade, PVC insulated, copper conductor cable of appropriate size, by using suitable copper crimping terminal ends etc.

Suitable bus links for input supply cable termination shall be provided.

### **3.13 Control Circuit & General Protection**

The control circuit shall be duly protected by using suitable rating MCB.

An emergency stop push button shall be provided to trip the entire system (22.5 mm dia, mushroom type, press to stop and turn to reset).

Wiring of the control circuit shall be done by using 1.5 sq. mm, 1100 V grade, PVC insulated, multi-stranded copper control FRLS wire.

Inspection terminal strip, number ferruling, labelling etc. shall be provided.

440 V caution board on the panel shall be provided.

### **3.14 Testing**

The capacitor bank shall be subject to test as specification relevant Indian Standards at the factory and the test certificates shall be furnished in quadruplicate.

#### **Installation**

i. Capacitors banks shall be installed as per installation manual of supplier and shall conform to relevant Indian Standards.

ii. All interconnections in the control panel shall be checked before commissioning.

iii. Cable end boxes shall be sealed after cable connections to prevent absorption of moisture.

iv. 15 mm thick rubber matting of an approved make over a 100 mm high Timber platform shall be provided in front of the full length of the capacitor bank and control panel.

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### **3.15 Testing & Commissioning**

i. Insulation resistance shall be tested with a 1000 volts meter between phases and phase to earth.

ii. Residual voltage shall be measured after switching of the capacitors and the same shall not be more than 50 volts after one minute.

i. Each discharge resistor shall be tested for its working.

## **SPECIAL CONDITIONS OF THE CONTRACT**

### **1. PRICES**

The prices to be quoted by the intending tenderer shall include the supply and installation, at the site, of all equipment, ancillary material and other items whatsoever required for carrying out the job to fulfil the intent and purposes as laid down in the specifications and/or the drawings.

The Tenderer's price shall be deemed to include all nuts, bolts, shims, clamps, supports etc., as required for proper fixing and/or grouting of equipment, ancillary items etc. Whether specifically mentioned or not the Contractor shall also include, in his price, all taxes duties or other levies (viz. Excise duty, customs duty, sales tax, octroi, works contract tax etc.,) which are legally livable on the air-conditioning equipment and installation. Failure to include all livable taxes and duties will not entitle the Contractor to any extra claims from the employer. However, the price shall be subject to adjustment, in case of statutory variation in the rate of any taxes or duties due to an act of legislature, within the originally agreed period, for the completion of the work.

### **2. ASSEMBLY AND INSPECTION:**

Shop assembly of all parts shall be made to ensure that all parts are properly fitted to minimize erection problems.

The purchaser reserves the right to inspect any machinery, material and equipment (hereinafter collectively called "Apparatus") finished or used by the Contractor under this Contract and may reject which is defective in workmanship or design or otherwise unsuitable for the use and purpose intended or which is not in accordance with the intent of this Contract. The Contractor shall on demand by the purchaser, remedy/replace at the Contractor's expenses any such

defective or unsuitable apparatus. The Contractor shall advise the purchaser in advance when apparatus is ready for inspection in the Contractor's workshop and/or in his sub supplier's workshop.

The purchase inspector shall at all times have access to all parts of shop where apparatus is being manufactured and also shall be provided with all reasonable inspection facilities by the Contractor and his sub supplier.

None of the apparatus to be furnished or used in connection with this Contract will be supplied until shop inspection and performance testing, wherever possible, satisfactory to the purchaser's inspector has been made. Such shop inspection of the apparatus shall not however, relieve the Contractor from full responsibility for furnishing the apparatus conforming to the requirements of this Contract not prejudice any claim, right or privilege which the purchaser may have because of the supply of defective or unsatisfactory apparatus. Should the purchaser waive the right to inspect any apparatus, such waiver shall not relieve the Contractor from his obligation under this Contract.

### **3. WORKING DRAWINGS, MAINTENANCE MANUALS ETC:**

On the award of the work, the Contractor shall immediately proceed with the preparation of detailed working drawings detailing the equipment that are to be installed and the ancillary works that are to be carried out. Three sets of all such working drawings shall be submitted to the engineer-in-charge, for his approval to ensure that the works will be carried out in accordance with the specifications and drawings, including such changes as may have been mutually agreed upon. All the drawings shall be received by the engineer-in-charge for his approval within three weeks of the award of work. The approval of the drawings by the engineer-in-charge shall in no way relieve the Contractor from his obligations to provide a complete and satisfactory plant and installation as per intent. Omissions and/or errors shall be made good or rectified whether or not the drawings are approved. Prior to the completion of the work the Contractor shall furnish (4) four sets of comprehensive manuals, describing all components, furnishing a list of instructions for the operations and maintenance of the plant. Any special tools required for the operation or the maintenance shall be supplied free with the plant.

### **4. ERECTION AND COMMISSIONING:**

The Contractor shall carry out the complete erection and commissioning. All work shall commence on previously prepared foundation. The Contractor shall move all the materials from their place of storage into the plant. The Contractor shall make his own arrangement to off load equipment/material received at respective rail/road transport terminal points, dispatched to site and to store all material received at site. The purchaser shall provide clear storage and erection space only. The Contractor shall provide all erection programmes.

All consumables required for erection such as cotton waste, kerosene oil, emery paper, coil string, bamboos and planks for scaffolding etc. as well as necessary welding rods, gases etc. shall be provided by the Contractor. The Contractor shall carry out protective and finish painting. Carbon steel surface shall be thoroughly cleaned before painting. The Contractor shall indicate the water and electricity requirements during erection. The Contractor shall remove all the waste material or rubbish from and about the work site and leave the job thoroughly cleaned up and ready to use

### **5. TESTING:**

All types of routine and type tests shall be carried out at the works of the Contractor or the manufacturers of the components. The Engineer-in-Charge/Architect shall be free to witness any or all tests if he so desires.

On the completion of the installation, the Contractor shall arrange to carry out various initial tests as detailed below in the presence of and to the complete satisfaction of the engineer-in-charge, and their Architects or their representatives. Any defects or shortcomings found during the tests shall be speedily rectified or made good by the Contractor at his own expense.

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

To operate and check the proper functioning of all electrically operated components viz., blowers, air handling units as well as other electrical motors.

To check the air distribution in the system and to provide design air flow in all areas specifically shown on the drawings by adjusting the grills, diffusers and dampers, which should be provided by the Contractor wherever required whether they are specifically shown on the drawings or not.

To check the system against leaks in different circuits, alignment of motor, 'V' belt adjustments, vibration and noise, power consumption etc.

Control setting and all such other tests, which are essential for smooth functioning of the plant.

On the satisfactory completion of all 'Initial' tests, the plant shall be considered to be 'Virtually Complete' for the purpose of taking over by the employer.

In addition to the 'initial' tests the Contractor shall also give three continuous running tests of the plant of 24 hours duration each. The running tests shall be taken on the completion of the initial tests.

The Contractor shall provide all necessary tools, instruments, gauges, flow meter ammeter etc. as may be required for conducting the various tests. He shall also provide necessary lubricants and the required personnel for the tests. However, the employer shall provide water and power for the tests.

#### **6. REJECTION OF DEFECTIVE PLANT:**

If on test any portions of the plant, equipment or components are found to be defective or not fulfilling the intent or the meaning of the specifications, the same shall be replaced or repaired to the entire satisfaction of the engineer-in-charge, and their Architects. In case the Contractor fails to remove the defects, within a period considered reasonable, the employer reserves the right to take necessary remedial measures through other agencies and all expenses thus incurred would be recovered from the Contractor.

The employer reserves the right to operate all the equipment and complete system whether or not the plant is taken over after the initial test and commissioning. Any defects found during the initial or running tests shall be removed at a suitable time as decided upon by the employer and/or their Architects.

#### **7. MAINTENANCE OF THE PLANT AND TRAINING OF PERSONNEL:**

The Contractor shall arrange to provide, at no extra cost necessary personnel and material to carry out all routine and special maintenance of the plant as required regularly for a period of (36) thirty six months from the date of commissioning.

#### **8. GUARANTEE:**

The Contractor shall guarantee that all the material, machinery and components supplied, fabricated, designed and installed by him shall be free from defects due to faulty design material and/or workmanship, that the plant shall perform satisfactorily and the efficiency of the system and all the components shall not be less than the values laid down in the specifications and the capacities shall be within + or - 3% of the specified values. In case of deviation greater than + or - 3%, the Contractor shall replace the necessary components at no extra cost or alternately the employer shall be entitled to deduct a proportionate amount from payments due to the Contractor.

The period of the guarantee shall be (36) thirty six months from the date of commissioning, during which period any or all components found to be defective shall be replaced free of charge and any shortcomings found in the system as specified shall be removed at no extra cost. The Contractor shall provide the necessary personnel and tools for fulfilling the above guarantee.

If for any reason the commissioning cannot be carried out then the plant shall carry a guarantee for a period of (15) fifteen months from the date of completion of erection at site.

If the defects are not removed within a reasonable time the employer may arrange to do so at the Contractor's risk and cost, without prejudice to any other's rights.

#### **9. PERFORMANCE GUARANTEE:**

The Contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.

#### **10. PAINTING**

All equipment and ancillary items such as piping, supports etc., will be painted in approved manner, using colour scheme as approved by the Architect.

#### **11. SAFE CUSTODY AND STORAGE:**

Safe custody of all machinery and equipment supplied by the Contractor shall be his own responsibility till the final taking over by the employer. He should, therefore, employ sufficient staff for watch and ward at his own expenses. The employer may, however, allow the Contractor to

use the Plant/AHU rooms, etc. for temporary storage of his equipment if such spaces are ready and available.

#### **12. BYE-LAWS AND REGULATIONS:**

The installation shall be in conformity with the Bye-laws, regulations and standards of the local authorities concerned, but if these specifications and drawings call for a higher standard of material and equipment than those required by above regulations and standards, then these specifications and drawings shall take precedence over said regulations & standards.

#### **13. QUIET OPERATION AND VIBRATION ISOLATION:**

All equipment shall operate under all conditions of load without any sound or vibration, which is objectionable in opinion of the supervisor. In case of rotating machinery, sound or vibration noticeable outside the room, if considered objectionable shall be corrected by Contractor at his own expense. All vibrating equipment located on terrace shall be mounted on steel structure and suitably vibration isolated.

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, each instruction shall be followed in all cases.

#### **14. TEST READINGS:**

All the equipment shall be supplied by the contractor after testing as required by various sections of specifications and test readings

#### **BALANCING, TESTING AND COMMISSIONING:**

Balancing of all air and water systems and all tests as called for the specifications shall be carried out by the contractor through a specialist ground, in accordance with the specifications and ASHRAE guide lines and standards. Performance test shall consist of three days of 10 hour each operation of system for each season.

The results for summer and monsoon air conditioning in quadruplicate shall be submitted for scrutiny. Four copies of the certified manufacturer's performance curves for each piece of equipment, high lighting operational parameters for the project, shall be submitted along with the test certificates. Contractor shall also provide four copies of record of all safety and automatic control settings for the entire installation.

The installation shall be tested again after removal of defects and shall be commissioned only after approval by the owner's representative. All tests shall be carried out in the presence of the representatives of the architect/engineer.

#### **15. MATERIALS AND EQUIPMENTS:**

All material and equipment's shall conform to the relevant Indian Standards and shall be of approved make and design. Makes shall be strictly in conformity with list of approved makes as per section 11.0.

#### **16. MODES OF MEASUREMENTS:**

The modes of measurements shall be as per section 13.0

#### **17. CONTRACTOR'S CONFIRMATION:**

The contractor shall confirm adherence to safety codes, design requirements & performance guarantee as per information given under section 12.0

#### **18. VARIATION IN QUANTITIES:**

The quantities of ducting, insulation, grills & diffusers given in the 'schedule of quantities' are indicative only and may vary as per the final approved drawings. In case there is any variation in the quantities of the items actually installed from the quoted quantities, the same shall be adjusted based on the units rates available in the contract. The rates shall remain firm till the completion of the project.

#### **19. CLEARING:**

Before commissioning of the plant, all mechanical equipment and ductwork shall be flushed / blown clear to ensure that they are thoroughly cleaned.

## **20. ACCESSIBILITY:**

The contractor shall verify the sufficiency of size of all equipment rooms, shaft openings and clearances for proper installation of equipment and ducting/piping. The contractor shall locate all equipment, which must be serviced, operated or maintained in fully accessible positions.

## **21. INTERPRETATION IN CASE OF CONTRADICTION WITHIN CONTRACT DOCUMENT:**

In case of any contradictions between general conditions of contract, technical specifications, special conditions, bill of quantities, consultant's drawings or contractor's drawings, the most stringent of the lot shall prevail and interpretation by owner in this regard shall be final.

## **23. COORDINATION WITH OTHER AGENCIES:**

The contractor shall maintain close coordination with other connected agencies and offer maximum cooperation to ensure that the project can be smoothly completed in time.

## **TECHNICAL SPECIFICATIONS**

### **SECTION -1 - BASIC SYSTEM DESIGN**

#### **1. SCOPE**

1.1 VRV air conditioning system has been proposed for the air conditioning of Intimate Theatre at Bhawartal Park at Jabalpur

1.2 The system is designed to cater air conditioning requirement to the different areas of the building. VRV outdoor units shall be installed at terrace level and refrigerant pipe shall run to cater the indoor units dedicated to the different areas.

1.3 Location INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR

#### **2. BASIS OF DESIGN**

##### **2.1 For General Areas**

Inside Conditions	Summer	:	23oC ± 1. 0o C DB RH not exceeding 60%
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#### **3. SYSTEM DESIGN**

3.1 It is proposed to provide a VRV system to maintain the specified inside design conditions during summer, monsoon for the selected areas of the Building.

3.2 The System shall be provided with multiple outdoor units separately.

3.3 The System shall be provided with multiple indoor units separately.

3.4 DX type AHU shall be provided.

3.5 Refrigerant shall be pumped to Indoor units and through insulated copper pipes installed in ceiling spaces and in vertical risers.

3.6 The conditioned air from the indoor units would be supplied through GSS/GI ducts. The air would be diffused through extruded aluminum Grilles and diffusers. The return air would be taken back from the conditioned space to the Indoor units through return air ducts or through ceiling spaces.

#### **4. INDOOR AIR QUALITY:**

Due consideration has been given for good indoor air quality.

Outdoor air ventilation rates have been maintained as per ASHRAE standard 62.1.2010 (Ventilation for acceptable indoor air quality).

### **SECTION -2 - VRV SYSTEM**

#### **1. GENERAL**

1.1 Unit shall be air cooled, split type multi-system air conditioner with Variable Refrigerant Flow technology consisting of one outdoor unit and multiple indoor units, each suitable to cool and heat independently for the requirements of the rooms.



1.2 The refrigerant piping shall be extendable up to 200m with 50m level difference without any oil traps.

## **2. OUTDOOR UNIT**

2.1 The outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing constructed from rust-proofed mild steel panels coated with a baked enamel finish.

2.1.1 The outdoor unit shall have multiple scroll compressors and be able to operate even in case of breakdown of one of compressors.

2.1.2 The connectable range of indoor units shall be from 0.65 TR to 10 TR with all outdoor units.

2.1.3 The noise level shall not be more than 55 dB(A) at normal operation measured horizontally 1m away and 1.5m above ground.

2.1.4 The outdoor unit shall be modular in design and shall be allowed for side by side installation.

## **3. COMPRESSOR**

3.1 The compressor shall be of highly efficient hermetic scroll type and equipped with capacity control technology capable of changing the speed in accordance to the cooling load requirement.

## **4. HEAT EXCHANGER**

4.1 The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil. The aluminum fins shall be covered by anti-corrosion resin film.

## **5. REFRIGERANT CIRCUIT**

5.1 The refrigerant circuit shall include an accumulator, liquid and gas shut off valves and a solenoid valves.

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

## **6. EV KIT & AHU CONTROL (FOR DX TYPE SYSTEM)**

The EV kit shall be used to combine refrigerant pipes coming from outdoor unit and then the main header shall be connected to the refrigerant pipe of AHU. The functioning of system shall be controlled by AHU control.

## **7. SAFETY DEVICES**

7.1 The following safety devices shall be part of the outdoor unit:

High Pressure Switch, Low Pressure Switch, Fan Motor Safety Thermostat, Inverter Overload Protector, Over Current Relay, Fusible Plugs, Fuses.

## **8. OIL RECOVERY SYSTEM**

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

## **9. INDOOR UNIT**

9.1 Indoor unit shall be DX type AHU, as specified in scope of work.

9.2 The address of the indoor unit shall be set automatically in case of individual and group control. In case of centralized control, it shall be set by liquid crystal remote controller.

## **10. REFRIGERANT PIPING**

10.1 All refrigerant piping for the air conditioning system shall be constructed from hard drawn seamless copper refrigerant pipes with copper fittings Y- joints, headers etc. and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include expansion valves, charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

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

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

Outside Dia (mm)	Wall Thickness (mm)
41.3, 38.1, 34.9	1.3
31.8, 28.6, 25.4, 22.2	1.2
19.1, 15.9	1.0
12.7, 9.5, 6.4	0.8

## 12. DRAIN PIPING

12.1 The indoor units shall be connected to drain pipe made of High density PVC pipe of 40 mm, 32 mm, 25 mm dia.

12.1.1 The pipes shall be laid in proper slope for efficient drainage of condensate water.

12.2 Drain Pipe Insulation

12.3 Drain pipes carrying condensate water shall be insulated with 6 mm Nitrile rubber having density 55 Kg/m<sup>3</sup> and K factor 0.37 w/mk at a mean temp. of 20°C.

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

## 13. PIPE INSULATION

13.1 Refrigerant Pipe Insulation

13.1.1 The whole of the liquid and suction refrigerant lines including all fittings, etc. shall be insulated with 19mm /13 mm thick Nitrile close cell rubber having density 55 Kg/m<sup>3</sup> and K factor 0.37 w/mk at a mean temp. of 20°C.

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

## SECTION - 3

### HORIZONTAL FLOOR MOUNTED AIR HANDLING UNITS

#### 1. SCOPE

This section of the specification covers the supply, installation, testing and commissioning of double skin construction air handling units conforming to these specifications and in accordance with requirement of the 'Schedule of Quantities', Drawings and 'Technical Schedule of Equipment'.

#### 2. TYPE

The air handling units shall be double skin modular, draw through type comprising of various sections such as mixing chamber (wherever R .AIR and F.AIR are ducted.), pre filter section, refrigerant coil section, fan section supply air plenum as per details given in Drawings and Schedule of Equipment.

#### 3. CAPACITY

The air handling capacities, maximum motor HP, static pressure shall be as shown on Drawings and as indicated in 'Schedule of Quantities'.

#### 4. CONSTRUCTION

4.1 AHU HOUSING / CASING:

4.1.1 The AHU housing shall be of double skin construction with main structure made of extruded aluminum hollow sections. The panels shall be double skin sandwich type with 0.8mm pre painted GSS/ pre-plasticized on the outside and 0.6 mm galvanized sheet inside with 25 mm thick PUF insulation material injected in between. These panels shall be screwed with soft rubber gasket fixed in built in groove of aluminum frame in between to make the joints airtight.

4.1.2 Framework for each section shall be joined together with soft Neoprene rubber gasket in between to make the joints airtight. Suitable airtight access doors /panels with nylon hinges and locks shall be provided for access to various sections for maintenance. The entire housing shall be mounted on roller-formed GSS channel framework having pressure die cast aluminum jointers.

4.2 DRAIN PAN

The drain pan shall be of 18 G aluminum/stainless steel with necessary slope to facilitate fast removal of condensate. It shall be provided with drain connection of suitable size complete with 25 mm rigid insulation. Necessary arrangement will be provided to slide the coil in the drain pan.

The drain pan shall be insulated with 12 mm thick close cell Nitrile insulation (self-adhesive) or equivalent.

#### 4.3 DX TYPE COOLING COIL

The refrigerant coil shall be of seamless copper tubes not less than 0.4 mm thick and 12mm OD. Coil face areas shall be such as to ensure rated capacity from each unit and such that air velocity across each coil shall not exceed 150 meters per minute. The coil shall be pitched in the unit casing for proper drainage. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of airflow.

The fins shall be uniformly bonded to the tubes by mechanical expansion of the tube for minimum thermal contact resistance with fins. Fin spacing shall be 10 to 13 FPI. The coils shall be tested against leaks at a hydraulic pressure of 38-kg/sq. cm. This pressure shall be maintained for a period of at least 2 hours. No drop should be observed indicating any leaks. The water headers shall be complete with water in /out connections, vent plug on top and drain at bottom and designed to provide water velocity between 2 to 6 FPS.

#### 4.4 FAN SECTION WITH FAN

The fan shall be backward curved, double inlet double width type. The wheel & housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame & pillow block heavy-duty ball bearings. The fan shall be selected for a speed not exceeding 1000 RPM. The impeller & fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 550 MPM. Fan housing with motor shall be mounted on a common extruded aluminum base mounted inside the air handling housing on anti-vibration spring mounts or cushy foot mounts of at least 90% vibration isolation efficiency. The fan outlet shall be connected to casing with the help of fire retardant double canvas or Neoprene rubber of imported Origin. The fan shall be selected for a noise level of less than 70 DB (A) at one meter distance.

#### 4.5 FILTER SECTION

Each unit shall be provided with a factory assembled filter section containing synthetic media washable air filters with efficiency of 90% down to 10-micron particle size. Filters shall have aluminum frame. Filter face velocity shall not exceed 150 meters per minute. Filter shall fit so as to prevent by pass. Holding frames shall be provided for installing number of filter cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels.

### 5. FRESH AIR INTAKES

Extruded aluminum construction duly anodized fresh air louvers with bird screen and extruded construction dampers shall be provided in the clear opening in masonry walls of the air handling unit room having at least one external wall. Fresh air louver, damper, pre filters, ducts and fresh air fan with speed regulator (wherever specified in 'Schedule of Quantities') shall be provided. Fresh air dampers shall be of the interlocking, opposed blade louver type. Blades shall be rattle free. Damper shall be similar to those specified in 'air distribution'. Fresh air fans and fresh air intakes shall be as per the requirements of 'Schedule of Quantities'.

### 6. SAFETY FEATURES

Each handling unit must have safety features as under:-

(a) The fan access door must have micro switch interlocked with fan motor to enable switching off the fan motor automatically in the event of door opening.

The access door shall further have wire mesh screen as an added feature, bolted on to the unit frame.

(b) Fan and motor base shall be properly earthed from the factory.

(c) All screws used for panel fixing and projecting inside the unit shall be covered with PVC caps to avoid human injury.

### 7. DRIVE

Fan drive shall be 3phase-squirrel cage totally enclosed fan cooled motor suitable for 415 □ 10%V, 50 HZ AC supply. Motor shall be specially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through Plug Fans.

### 8. DESIGN DATA FOR AIR HANDLING UNITS

(a) Fan outlet velocity shall not exceed 500 MPM.

(b) The air velocity across coil shall not exceed 150 MPM.

(c) The air velocity across air pre filter shall not exceed 150 MPM.

Motor ratings are only tentative and shall be suitable for the duty but not less than the specified HP. The motor shall be selected with a safety factor of at least 20% over and above the brake power.

The AHU fan shall be selected for a total static pressure as indicated in 'Schedule of Quantities'.

## **9. INSTALLATION**

Air Handling Unit shall be installed inside the AHU room to permit the removal of all the parts of AHU for any maintenance work without dismantling other equipment such as plenum, pipes, ducts etc. Air handling unit installation shall be carried out as per manufacturer's recommendation and mounted on serrated rubber pads. The serrated rubber pads shall be in two layers with 16G GI sheet sandwiched in between.

## **10. PERFORMANCE DATA**

Air handling unit shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data with operating points clearly indicated shall be submitted and verified at the time of testing, commissioning of the installation.

## **SECTION -4 - SHEET METAL WORKS - (FACTORY FABRICATED)**

### **1. GENERAL**

1.1 The work under this part shall consist of furnishing labour materials, equipment and appliances as specified necessary and required to install all sheet metal and other allied work to make the air conditioning supply, ventilating, and exhaust system ready for operation as per drawings.

1.2 Except as otherwise specified all duct work and related items shall be in accordance with these specifications.

1.3 Ductwork shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

### **2. DUCT MATERIALS**

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII conforming to ISS: 277-1962 (revised) or aluminum sheets conforming to ISS: 737-1955 (wherever aluminum ducts are specified).

2.2 All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with Amendment-I (1971 edition)

### **Governing Standards**

2.3 Unless otherwise specified here, the construction, erection, testing and performance of the ducting system shall conform to the SMACNA-1995 standards ("HVAC Duct Construction Standards-Metal and Flexible-Second Edition-1995" SMACNA)

### **3. RAW MATERIAL**

#### **3.1 Ducting**

3.1.1 All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I. raw material furnished with accompanying Mill test Certificates.

3.1.2 Galvanizing shall be of 120gms/sq.m. (total coating on both sides).

3.1.3 In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

3.1.4 The G.I. raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross-section dimensions.

#### **3.2 Duct Connectors and Accessories**

All transverse duct connectors (flanges/cleats) and accessories/related hardware are such as support system shall be zinc-coated (galvanized)

### **4. FABRICATION STANDARDS**

4.1 All ductwork including straight sections, tapers, elbows, branches, show pieces, collars, terminal boxes and other transformation pieces must be Rolastar factory-fabricated or Techno

Fabriduct. Equivalency will require fabrication by utilizing the following machines and processes to provide the requisite quality of ducts and speed of supply.

4.2 Coil lines to ensure location of longitudinal seams at comes/folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any face side of the duct.

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

4.4 All edges to be machine treated using lock formers, flanges and roller for fuming up edges.

4.5 Sealant dispensing equipment for applying built-in sealant in Pittsburgh lock where sealing of longitudinal joints are specified.

**5. SELECTION OF G.I. GAUGE AND TRANSVERSE CONNECTORS**

Duct Construction shall be in compliance with 1" (250 Pa) w.g. static norms as per SMACNA.

All transverse connectors shall be the Rolamate 4-bolt slip-on flange system or Techno Fabriduct imported makes of similar 4-bolt systems with built-in sealant if any to avoid any leakage additional sealant to be used.

The specific class of transverse connector and duct gauge for a given duct dimensions will be 1"(250 Pa) pressure class.

Non-toxic, AC-applications grade P.E. or PVC Casketing is required between all mating flanged joints. Gasket sizes should conform to flange manufacturer's specification.

**6. DUCT CONSTRUCTION**

The fabricated duct dimensions should be as per approved drawings and all connecting sections are dimensionally matched to avoid any gaps.

**7 DIMENSIONAL TOLERANCES:** All fabricated dimensions will be within ± 1.0 mm of specified dimension. To obtain required perpendicularity, permissible diagonal tolerances shall be ± 1.0 mm per meter.

7.1 Each and every duct pieces should be identified by color coded sticker which shows specific part numbers, job name, drawing number, duct sizes and gauge.

7.2 Ducts shall be straight and smooth on the inside Longitudinal seams shall be airtight and at comers only, which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice, to ensure air tightness.

7.3 Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitters shall be installed in all bends and duct collars designed to permit the air to make the tum without appreciable turbulence.

7.4 Plenums shall be shop/factory fabricated panel type and assembled at site.

7.5 Factory Fabricated ducts shall have the thickness of the sheet shall be as follows:

S.No.	Size of Duce	Sheet Thickness	Fasnr Size	Type of Joints		Bracing with GI tie rods following sizes	Support of Angle
				For Rolamate flanges	For Techno & Fabriduct and flanges		
7.5.1	Upto 750 mm	0.63 mm	3/8"	Fabricated out of G.I. sheet of 24 gauge at every 1.2 m	The flanges shall be made out of the same duct sheet	Cross tie rods to be fitted of	25x25x3 mm
7.5.2	751 mm to 1000 mm	0.80 mm	3/8"	E-24 type flange, shall be fabricated out of 24 G sheet at every 1.2 m internal.	and all the four corner shall be fitted for fitting the	suitable dia GI rod for each piece of duct	25x25x3 mm

7.5.3	1001 mm to 1500 mm	0.80 mm	5/8"	E-22 type flange, shall be fabricated out of 22 G sheet at every 1.2 m internal.	The flanges shall be made out of the same duct sheet and all four corner shall be fitted for fitting the	Cross tie rods to be fitted of suitable dia GI rod for each piece of duct	40x40x5 mm
7.5.4	1501 mm to 2250 mm	1.00 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m internal.	for fitting the		40x40x6 mm angle
7.5.5	2251 mm and above	1.25 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m internal.	bolt		50x50x6 mm with MS rods of 12 mm dia.

- 7.1 The gauges, joints and bracings for sheet metal duct work shall further conform to the provisions as shown on the drawings.
- 7.2 Ducts larger than 600 MM shall be cross broken, duct sections up to 1200 MM length may be used with bracing angles omitted.
- 7.3 Changes in section of ductwork shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 DEG. Angle from the axis of the main duct unless otherwise approved by the Engineer-In-Charge.
- 7.4 All ducts shall be supported from the ceiling/slab by means of M.S. Rods of 10 MM (3/8") DIA with M.S. Angle at the bottom. The rods shall be anchored to R.C. Slab using metallic expansion fasteners.

## 8. INSTALLATIONS

- 8.1 During the construction, the contractor shall temporarily close duct openings with sheet metal covers to prevent debris entering ducts and to maintain opening straight and square, as per direction of Engineer-In-Charge.
- 8.2 Great care shall be taken to ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.
- 8.3 All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be air tight and shall be made in the direction of air flow.
- 8.4 The ducts shall be re-inforced with structured members where necessary, and must be secured in place so as to avoid vibration of the duct on its support.
- 8.5 All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration.

The duct work shall be varied in shape and position to fit actual conditions at building site. All changes shall be subjected to the approval of the Engineer-In-Charge. The contractor shall verify all measurements at site and shall notify the Engineer-In-Charge of any difficulty in carrying out his work before fabrication.

- 8.6 Sponge rubber or approved equal gaskets of 6 MM maximum thickness shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns, heater casings and filter casings. Sheet metal connections shall be made to walls and

floors by means of wooden member anchored to the building structure with anchor bolts and with the sheet screwed to them.

8.7 Flanges bracings and supports are to be Rolamate or Techno Fabriduct. Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

8.8 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct details as specified, or as decided by Engineer-In-Charge.

8.9 Joints requiring bolting or riveting may be fixed by Hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre top rivets or spot welding. Self tapping screws must not be used. All jointing material must have a finish such as cadmium plating or Galvanized as appropriate.

8.10 Fire retarding flexible joints are to be fitted to the suction and delivery of all fans. The material is to be normally double heavy canvass or as directed by Engineer-In-Charge. On all circular spigots the flexible materials are to be screwed or clip band with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.

8.11 The flexible joints are to be not less than 75 MM and not more than 250 MM between faces.

8.12 The duct work should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling contractors.

8.13 Duct passing through brick or masonry, wooden frame work shall be provided within the opening. Crossing duct shall have heavy flanges, collars on each side of wooden frame to make the duct leak proof.

## **9.0 DOCUMENTATION TO MEASUREMENTS**

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

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

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

## **10. TESTING**

After duct installation, a part of duct section (approximately 5% of total ductwork) may be selected at random and tested for leakage. The procedure for leak testing should be followed as per SMACNA- "HVAC Air Duct Leakage Test Manual: (First Edition).

SECTION -5 - QUALITY CHECKS ON DUCTING

S.No.	DESCRIPTION	YES - OK NO - X	REMARKS
1.	Whether material adheres to Fabrication Standards as specified (Lock form Quality Sheets)		
2.	Valid for construction Drawings. at site.		
3.	Cross breaking, bracings / reinforcements are as per standard.		
4.	Air tightness of transverse / Longitudinal Joints ensured		
5.	Grease and heat resistant sealant for kitchen exhaust duct		
6.	Neoprene gaskets for pharmaceutical and clean room projects used		
7.	Check following aspects of duct supporting system		
7.1	Hanger spacing		
7.2	Anchor bolts size and quality		
7.3	Primer painting of supports		
7.4	Check allowable load on trapeze angle for bigger ducts		
8.	Check whether contractor has provided		
8.1	Vanes in elbows		
8.2	Clinched collar at take Offs		
8.3	Splitters		
9.	Check transitions & offsets slopes & fabrication.		
10.	Whether the installed ducting is as per layout approved, check locations, headroom etc.		
11.	Whether grilles / diffusers are as per approved shade.		
12.	Check the method of installation for Grilles / Diffusers		
13.	Repair / paint damaged surfaces.		
14.	Check the coordination of following activities as per the given sequence:-		



14.1	Main Ducts Cut for taking collars		
14.2	Match / Fabricate collar taking false ceiling framework for diffuser into account		
14.3	Fix grilles / diffuser framework in false ceiling		
14.4	Install the collar		
14.5	Install diffuser		
15.	All elbows / turning points and branches to be properly supported		
16.	Access door is provided at serviceable position for fan and fire damper		
17.	Air balancing for room is studied		
18.	Air replacement is considered for air exhausted from rooms		
19.	PVC or stainless steel material is used for corrosive fume exhaust system.		
20.	Anti-vermin netting installed for louvers removable and serviceable.		
21.	Water or gas vent outlet is not installed near air intake louver.		
22.	Kitchen exhaust is not short circuited to outdoor air intake louver.		
23.	Kitchen room pressure is slightly below the surrounding area.		
24.	Sound level of fan is studied.		
25.	Face velocity for louvers / grills / diffusers is studied.		
26.	Air distribution of the room is studied.		
27.	Cross break all flat surfaces to prevent vibrations or buckling due to air flow.		
28.	Sides of ducts having collar for grills should not be cross broken to facilitate alignment of grills.		
29.	All bends and collars should have vanes.		
30.	If duct passes through fire chamber increase sheet thickness.		
31.	Kitchen exhaust ducts to be tapered at bottom for oil / grease collection.		
32.	Avoid flanged joints in kitchen exhaust duct above false ceiling.		
33.	When aluminum ducts are used with steel angles, steel to be painted with Zinc chromate paint		
34.	Provide check nuts with duct hangers		
35	Ducts below 250 mm should not be more than 1 m long to facilitate proper joining.		

36.	Plenums should have flanged and bolted ends for rigidity and easy maintenance.		
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37.	Avoid 'U' bends in ducts		
38.	Provide long radius bends and offsets.		
39	No collars to be taken from top.		
40.	Install duct spool pieces near equipment for easy removal.		

## SECTION -6 - INSULATION

### 1 SCOPE

The scope of this section comprises supply and fixing of acoustic lining conforming to these specifications.

#### 2.1 Duct Work Insulation

- 1) Duct insulation material shall be duly laminated aluminum foil of mat finish closed cell Nitrile rubber (class "O") insulation on existing duct after applying two coats of cold setting adhesive (CPRX compound). The joints shall sealed with 50 mm wide and 3 mm thick self-adhesive nitrile rubber tape insulation complete as per specifications and as required

#### Unconditioned Space

#### Conditioned Space

1 Supply Air Duct	19 mm insulation.	25 mm insulation
2 Return Air	Nil	25 mm insulation

- |                             |   |
|-----------------------------|---|
| (a) Conditioned Exhaust Air | To be completely insulated with 12 mm thick insulation  |
| (b) Plenums                 | To be insulated from outside with 40 mm thick insulation or lined internally with 25 mm thick insulation. |
| (c) Fresh air duct          | To be completely insulated with 25 mm thick insulation  |

### 3. DUCT ACCOUSTIC LINING

The ducts so identified and marked on drawings and in 'Schedule of Quantities' shall be provided with acoustic lining of thermal insulation material as follows: -

#### 3.1 Material for Duct Lining

The material to be used for duct lining shall be 25 mm thick resin bonded glass wool having a density of 32 kg/cu.mt and covered with 26 gauge thick perforated aluminum sheet with at least 20% perforation. The value at 32°C shall not be less than 0.034 KCAL / HR / MTR / Deg C

#### 3.2 Application

- a) Clean inside surface of the duct.
- b) Apply a coat of CPRX compound.
- c) Fix the board inside the duct provided with GI channel 25 x 25 mm screwed on duct surface with self-tapping screws to make grid of 600 x 600 mm.
- d) The inner surface should now be covered with fiberglass RP tissue.
- e) Cover the insulation boards with 26 G perforated aluminium sheet with at least 20% perforation.
- f) Secure the insulation board and aluminium sheet with cadmium plated bolts and washers.

g) Seal the ends completely so that no insulation material is exposed.

#### **4. FIRE BREAKS INSULATION**

Firebreaks shall be provided in all ducts for internal lining/external thermal insulation after a run of 10 m centre to centre. There shall be a discontinuity of the insulating material in the form of MS angle of a minimum of 50 mm x 50 mm x 3 mm size. At the interface of the MS angle and insulating material, proper care of tucking in of the insulating material shall be taken so as to prevent erosion.

#### **5. UNDER DECK INSULATION**

Supply of EPS material for under – deck application. Light and easy to handle the boards have a density of 30-32 Kg/m<sup>3</sup> and available in standard size of 1250 x 600 mm in various thicknesses.

Normally for roof, thickness of under deck insulation required is 50mm i.e. 'R' value of 1.78 or 'U' value of 0.56 in metric units.

Insulation is laid with its shiplapped joints tightly butted in single or multiple layers depending upon the specific 'U' value requirements .

'U' factor is the transfer of energy through the building assembly per unit time, per unit area and temperature difference .

It offers a compressive strength of 250kPa, water absorption of < 1% ( V/V) and a thermal conductivity of 0.028 W/moK at a mean temperature of 25oC.

### **SECTION -7 - MODES OF MEASUREMENTS**

#### **1. UNIT PRICES IN THE SCHEDULE OF QUANTITIES**

1.1 The item description in the 'Schedule of Quantities' is in the form of a condensed resume. The unit price shall be held to include everything necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.

1.2 The Unit price of the various items shall include the following:

1.2.1 All equipment's, machinery, apparatus and materials required as well as the cost of any tests which the Consultant may request in addition to the tests generally required to prove quality and performance of the equipment's.

1.2.2 All the labour required supplying and installing the complete installation in accordance with the specifications.

1.2.3 Use of any tools, equipment's, machinery, lifting tackle, scaffolding, ladders etc. Required by the Contractor to carry out his work.

1.2.4 All the necessary measures to prevent the transmission of vibration.

1.2.5 The necessary material to isolate equipment's foundations from the building structure, wherever necessary.

1.2.6 Storage and insurance of all equipment's apparatus and materials.

1.2.7 The Contractor's unit price shall include all equipment's, apparatus, material and labour indicated in the drawings and/or specifications in conjunction with the item in question, as well as all additional equipment's, apparatus, material and labour usual and necessary to make in question on its own (and within the system as a whole) complete even though not specifically shown, described or otherwise referred to.

#### **2 MEASUREMENTS OF SHEET METAL DUCTS, GRILLES/DIFFUSERS ETC.**

##### **2.1 Sheet Metal Ducts**

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

2.1.2 For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway large and small diameter shall

be adopted, the length of tapered duct section shall be the center line distance between the flanges of the duct section. or special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centerline.

2.1.3 The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 3 mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber / access panel. Splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for. Grilles/Diffusers

Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.

Diffusers - cross section area for airflow at discharge areas, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.

Linear diffusers - shall be measured by cross - sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.

Fire dampers - shall be measured by their cross sectional areas perpendicular to the direction of airflow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel No special allowance shall be payable for extension of cross section outside the air stream.

Flexible connection - shall be measured by their cross sectional areas perpendicular to the direction of airflow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.

Exhaust Hoods - shall be measured by their cross sectional area at the capture point of fumes, parallel to the surface of kitchen equipment's. Quoted rates shall include the grease filters, provision for hood light, suspension arrangement for the hood, profile to direct the air to ventilation ducts and provision for removable drip tray.

### 2.3 Dampers

Measurement of dampers shall be as per internal cross sectional area of the damper

## **3 MEASUREMENTS OF PIPING, FITTINGS ITEMS**

### 3.1 PIPES

3.1.1 All pipes shall be measured in linear meter (to the nearest cm) along the axis of the pipes and rates shall be as per the items given in Schedule of Quantities'.

4.1.2 The rate quoted shall be inclusive of cutting holes, exposing reinforcement in wall and ceiling and floors and making good the same and inclusive of all items as specified in specifications and 'Schedule of Quantities'.

4.1.3 Rates quoted shall be inclusive of providing and fixing vibration pads and wooden pieces. Wherever specified or required by the project engineer.

4.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter with no additional allowance being made for providing the same.

4.1.5 The length of the pipe for the purpose of payment will be taken through the centreline of the pipe and all through the fittings (e.g., tees, Bends, reducers, elbows, etc.) As through the fittings are also presumed to be pipe lengths.

## **SECTION -8 - SAFETY CODES**

### **1. SCOPE**

The scope of this sub-section is the minimum safety requirements to be observed during manufacture and erection of the HVAC system as specified herein in addition to the safety norms generally followed.

### **2. I.S. STANDARDS**

The safety code for mechanical refrigeration IS: 660 and safety code for air conditioning IS: 659 shall be observed.

**3. SAFETY REQUIREMENTS**

Some of the important safety requirements are as under but not limited to the same:-

- a) There shall be maintained in a readily accessible place, first aid appliances including adequate supply of sterilized dressings and cotton wool.
- b) The injured person shall be taken to a public hospital without loss of time.
- c) Suitable and strong scaffolds shall be provided for workmen for all works that cannot be safely done from ground.
- d) No portable single ladder shall be over 8 meters in length. The width between side rails shall not be less than 30 cm (clear) and the distance between two adjacent rings shall not be more than 30 cms, when a ladder is used, an extra tandoor shall be engaged for holding the ladder.
- e) The excavated material shall not be placed within 1.5 meters of the edge of the trench or half of the depth of trenches whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.
- f) Every opening in the floor of a building or in a working platform to be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one meter.
- g) No. Floor, roof or other part of the structure shall be so overloaded with debris or material as to render it unsafe.
- h) Workers employed on mixing and handling materials such as asphalt, cement mortar or concrete & lime mortar shall be provided with protective footwear and rubber hand gloves. Those engaged in welding works shall be provided with protective eye shields and glove. No paint containing lead or lead products to be used except in the form of paste or readymade paint. Suitable facemasks shall be supplied for use of workers when the paint is applied in the form of spray or surface having lead paint dry rubbed and scraped. Overalls shall be supplied by the Contractor to the painter and adequate facilities shall be provided to enable the working painter to wash during cessation of the work. The ropes used in hoisting or lowering material or as a means of suspension, shall be of adequate quality and adequate strength and free from defects. All site personnel shall wear safety helmets whenever they are in the construction/erection areas.

**SECTION – 9 - TECHNICAL SCHEDULE OF EQUIPMENTS**

The capacity/ratings of various equipment’s in this contract are for guidance purpose only. a/c contractor shall check in details the design/selection of equipment’s. a/c contractor shall be finally responsible for maintaining the desired inside conditions and shall not deprive him of the responsibility if selection of equipment’s is not thoroughly checked. in case of shortfall the a/c contractor shall replace/modify equipment’s for achieving desired parameters without any extra cost to owner/employer.	
<b>1.0 WATER PIPES</b>	
i. Material	Copper
ii. Class	
iii. Wall Thickness	
41.3 mm-34.9mm	1.3
28.6 mm-22.2mm	1.2

19.1 mm-15.9mm	1.0	
12.7 mm-6.4mm	0.8	
200 MM TO 610 MM	6.35	
<b>2.0 GSS DUCTING</b>		
i. Class of Galvanizing	VIII (120 GM/SQM)	
ii. Code of Fabrication	IS - 655 (LATEST)	
iii. Material of Hangers	MS	
iv. Quality of Sheet	LFQ	
<b>3.0 INSULATION</b>		
<b>A) DUCTS</b>		
i. Material	Nitrile Rubber	
ii. Density	32 Kg/m3	
<b>B) ACOUSTIC LINING</b>		
i. Material	Fiberglass	
ii. Density	32 Kg/m3	
<b>C) PIPE INSULATION</b>		
i. Material	Nitrile Rubber	
ii. Density	55 Kg/m3	

**SECTION – 10 - TEST READINGS**

**10.1 RECTANGULAR DUCT**

**TRAVERSE REPORT**

PROJECT \_\_\_\_\_ SYSTEM \_\_\_\_\_

LOCATION / ZONE \_\_\_\_\_ ACTUAL AIR TEMP. \_\_\_\_\_ DUCT S.P \_\_\_\_\_

DUCT	REQUIRED	ACTUAL
SIZE _____	FPM _____	FPM _____
SQ.FT. _____	CFM _____	CFM _____

POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
1													
2													
3													
4													
5													
6													

7													
8													
VELOCITY SUBTOTALS													





Reference Document	Extent of Deviation	Reason	Section	Page	Clause No. of BID
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1. Technical
2. Contractual

Company Seal  
 Signature \_\_\_\_\_  
 Designation \_\_\_\_\_  
 Company \_\_\_\_\_  
 Date \_\_\_\_\_

**11.2 CONTRACTOR'S CONFIRMATION**

**1. SAFETY CODES**

We confirm that we shall strictly follow the safety codes as given in subsection 2.3

**2. DESIGN CONFIRMATION**

2.1 Except for the deviation contained in enclosed format 3.1, we agree to all the conditions of the Contract, special conditions, technical specification, makes and BOQ

2.2 The design on which this bid is prepared has been verified by us and we guarantee to maintain the inside conditions as stipulated in the Contract documents with the system offered. We further confirm that design meets with the requirements of all government, semi-government, municipal, local and other authorities, whose permission would become necessarily for completion of the project. In our opinion the design is economical and safe and we have nothing further to suggest either by way of effecting further economy or providing additional safety.

2.3 The space allocation shown on the drawings for the various equipment's has been checked by us and it will be possible for us to install our equipment's in the space allocated.

2.4 Routing of ducting as shown in tender drawings is feasible and can be executed by us without any additional space requirements.

2.5 The technical information on the equipment's / material offered by us and any other information / clarification required by you or your Consultants will be furnished strictly in conformity with the tender documents within two weeks from date of receipt of letter of intent.

**11.3 DETAIL OF WORKS OF SIMILAR NATURE & MAGNITUDE CARRIED OUT DURING LAST 3 YEARS.**

WORK DONE & COST	STARTED	COMPLETED	REFERENCE PERSON
------------------	---------	-----------	------------------

SEAL OF COMPANY  
 SIGNATURE OF THE BIDDER

DESIGNATION \_\_\_\_\_

COMPANY \_\_\_\_\_

DATE \_\_\_\_\_

#### 11.4      **TRAINING OF OWNER'S PERSONNEL**

1. The Vendor/Contractor shall train the Owner/Purchaser's engineering personnel in the shops, where the equipment's will be manufactured and or in their collaborator's works and where possible, in any other plant where equipment's manufactured by the Vendor/Contractor or his collaborator is under installation or test to enable those personnel to become familiar with the equipment's being furnished by the Vendor/Contractor, either at his works or at his Sub-Vendor's/Sub-Contractor's works or at site.
2. The period of training shall be adequate and mutually agreed upon by the Owner/Purchaser and the Vendor/Contractor.
3. The training shall be so oriented as to make the Owner's/Purchaser's personnel proficient in operating the equipment's.
4. The Owner's/Purchaser's personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing and replacement procedures to be adopted for the equipment's offered.
5. The Vendor/Contractor shall train the Owner's/Purchaser's personnel in carrying out minor repairs, if need arises, during the operation of the equipment's.
6. The charges for training the Owner's/Purchaser's personnel, if any, be included in the price for supply of erection, testing and commissioning.

#### **SECTION – 12 - LIST OF BUREAU OF INDIAN STANDARD CODES**

IS 1239 (Part-I) 1979	Mild Steel Tube
IS 1239 (Part – I) 1982	Mild Steel Tubular and Other Wrought Steel Pipe Fittings
IS 4736 – 1986 (Reaffirmed)	Hot Dip Zinc Coatings of Steel Tubes
IS 823-1964	Code of Procedure For Manual Metal Arc Welding of Mild Steel
IS 780-1984	Service Valves For Water Works Purpose
IS 778-1980	Copper Alloy Gate, Globe and Check Valves For Water Works Purpose
IS 1536-1976	Flanges Configuration
IS 5312 (Part –I) 1984	Swing Check Type Reflux Non Return Valves For Water Works
IS 2379-1963	Color Code For Identification of Pipelines
IS 554-1975	Dimension For Pipe Thread Where Pressure Tight Joints Are Required On Threads
IS 655-1963 (Reaffirmed 1991)	Metal Air Ducts
IS 277-1992	Galvanized Steel Sheet For Fencing
IS 4064 Part II-1978	Specific Requirements For Direct Switches of Individual Motors
IS 3854-1969	Switches For Domestic & Similar Purpose
IS 732 (Part III-1902)	Inspection and Testing of Installation
IS 659 – 1964 (Reaffirmed 1991)	Air Conditioning Safety Code
IS 660 – 1963 (Reaffirmed 1991)	Mechanical Refrigeration ( Safety Code)
IS 4894 – 1991	Test Code For Centrifugal Fan
IS 3103 – 1975 Reaffirmed 1994	Code of Practice For Industrial Ventilation

IS 7240 – 1981	Application & Finishing of Thermal Insulation Material
IS 325	Specifications For Three Phase Erection Motor
IS 3142 – 1993	V Grooved Pulley
BS-EN-779 – 1993	Particulate Air Filters For General Ventilation
IS 702 – 1988	Industrial Bitumen
IS 8183 – 1993	Bonded Mineral Wool
IS 2494 – 1993	V Belts For Industrial Purposes
IS 2062 – 1992	General Purpose Steel
ASHRAE Hand Books	American society of heating, refrigeration and air conditioning books - Applications 1999 - Fundamentals 1997 - System and equipment's 1996 - Indoor air quality 62 – 1999

**SECTION – 13 - LIST OF APPROVED MAKES OF MATERIALS (HVAC)**

<b>S.No</b>	<b>Equipment / Material</b>	<b>Approved Makes</b>
	<b><u>HVAC WORKS</u></b>	
1.	VRV/VRF Outdoors/Indoors	Daikin/ Mitsubishi Electric/ Samsung/ Toshiba
2.	Header/ Separator/ Refrigerant pipes	Daikin/ Mitsubishi Electric/ Samsung/ Toshiba
3	DX AHU	Edgetech/waves/Brightflow
4	Air Distribution/Ducting GI Sheets	Sail / Tata / Jindal/Zeco
5	Factory Fabricated Duct & Flanges	Rolastar / Zeco / Dynamic
6	Dust Insulation	Armaflex/ Vidoflex
7	Extruded Aluminum Grills/Diffusers	Air Track Concept/ Caryaire / Trox
8	Fire / Smoke Dampers	Air Track Concept/ Caryaire / Trox
9	Extended Polystyrene (EPS) for underdeck Insulation	Styrene Packing/ Perfect Pack
10	Insulation : a) Fibre Glass – For Acoustic Lining	UP Twiga / Owens Corning/ Styrene Packaging
11	Insulation : c) Nitrile rubber for Refrigerant piping	Kflex/Armacell
12	Dash Fasteners	HILTI / Fischer / Cannon / Wurth
13	Extruded Aluminum Sections	Mahavir / Jindal
14	PVC Drain Pipe	Polypack/ Supreme
15.	Inline /Propeller fans	Caryaire/Airflow

#### 4) LIFTS:

5) 8 PASSENGER, Unit 1		
CAPACITY (kgs)	:	544 Kg, 8 persons.
SPEED (mps)	:	1 mps
RISE (m)	:	10 m
STOPS	:	2 Stops With (all opening on the same side)
CONTROLLER TYPE	:	ACD3-MRL
DRIVE	:	VF Regenerative (Closed Loop)
POWER SUPPLY	:	400/415 Volts (3 Phase AC)
OPERATION	:	Full collective operation
CAR GROUP	:	One car (simplex)
MACHINE	:	PM Gearless (Located in shaft on top of guide rails)
TRACTION MEDIA	:	Flat Coated Steel Belt
CAR FINISH	:	<ul style="list-style-type: none"> <li>• Rear Mid Panel = Stainless Steel #4(Hairline)</li> <li>• Rear Corner Panels = Stainless Steel #4(Hairline)</li> <li>• Side Mid Panels = Stainless Steel #4(Hairline)</li> <li>• Side Corner Panels = Stainless Steel #4(Hairline)</li> <li>• Front Panels = Stainless Steel #4(Hairline)</li> </ul>
FALSE CEILING TYPE	:	CD-41
FLASE CEILING FINISH	:	Stainless Steel #4(Hairline)
VENTILLATION	:	Cross flow fan
HAND RAILS	:	STEEL POWDER PAINTED BLACK Handrails on rear car panels
FLOORING	:	MARBLE
CAR DOOR FINISH	:	Stainless Steel #4(Hairline)
LANDING DOORS FINISH	:	Stainless Steel #4(Hairline)
FIRE RATED DOORS	:	Fire rating-60mins
PIT DEPTH	:	1350
OVERHEAD	:	4000
HOISTWAY DIMENSIONS (W x D - mm)	:	2100 mm W x 1900 mm D
CAR DIMENSIONS (W x D x H - mm)	:	1100 mm W x 1300 mm D x 2200 mm D
CAR & HOISTWAY DOOR TYPE	:	Central opening (CO) doors
DOOR OPENING (W x H - mm)	:	800 mm W x 2000 mm H
DOOR OPERATOR	:	DC Door Operator

COP	:	Gien Buttons in Stainless Steel #4(Hairline)
CAR POSITION INDICATOR	:	Dot matrix (LED) Scrolling Display
HALL FIXTURES	:	O2000 Flat Type Fixture ,
HALL FIXTURE FACE PLATE	:	Stainless Steel #4(Hairline)
HALL BUTTON ARRANGEMENT	:	LCD Monochrome type
STANDARD FEATURES	:	Anti-nuisance Car Call Protection, Independent Service (for Duplex only), Overload Device, Nudging, Emergency Firemen's Service, Emergency Car Light Unit, Infrared Curtain Door Protection, Door Time Protection, Emergency Alarm Button, Extra Door Time of Lobby & Parking, Door Open/Close Button, Manual Rescue Operation, Belt Inspection Drive, Auto Fan Cut Off

<b>13 PASSENGER, Unit 1</b>		
CAPACITY (kgs)	:	884 Kg, 13 persons.
SPEED (mps)	:	1 mps
RISE (m)	:	10 m
STOPS	:	2 Stops With (all opening on the same side)
CONTROLLER TYPE	:	ACD3-MRL
DRIVE	:	VF Regenerative (Closed Loop)
POWER SUPPLY	:	400/415 Volts (3 Phase AC)
OPERATION	:	Full collective operation
CAR GROUP	:	One car (simplex)
MACHINE	:	PM Gearless (Located in shaft on top of guide rails)
TRACTION MEDIA	:	Flat Coated Steel Belt
CAR FINISH	:	<ul style="list-style-type: none"> <li>• Rear Mid Panel = Stainless Steel #4(Hairline)</li> <li>• Rear Corner Panels = Stainless Steel #4(Hairline)</li> <li>• Side Mid Panels = Stainless Steel #4(Hairline)</li> <li>• Side Corner Panels = Stainless Steel #4(Hairline)</li> <li>• Front Panels = Stainless Steel #4(Hairline)</li> </ul>
FALSE CEILING TYPE	:	CD-42
FLASE CEILING FINISH	:	Stainless Steel #4(Hairline)
VENTILLATION	:	Cross flow fan
HAND RAILS	:	STEEL POWDER PAINTED BLACK Handrails on rear car panels
FLOORING	:	MARBLE
CAR DOOR FINISH	:	Stainless Steel #4(Hairline)
LANDING DOORS FINISH	:	Stainless Steel #4(Hairline)
FIRE RATED DOORS	:	Fire rating-60mins
PIT DEPTH	:	1350
OVERHEAD	4000	
HOISTWAY DIMENSIONS (W x D - mm)	:	1900 mm W x 2550 mm D
CAR DIMENSIONS (W x D x H - mm)	:	1100 mm W x 2000 mm D x 2200 mm D

CAR & HOISTWAY DOOR TYPE	:	Central opening (CO) doors
DOOR OPENING (W x H - mm)	:	800 mm W x 2000 mm H
DOOR OPERATOR	:	DC Door Operator
COP	:	Gien Buttons in Stainless Steel #4(Hairline)
CAR POSITION INDICATOR	:	Dot matrix (LED) Scrolling Display
HALL FIXTURES	:	O2000 Flat Type Fixture ,
HALL FIXTURE FACE PLATE	:	Stainless Steel #4(Hairline)
HALL BUTTON ARRANGEMENT	:	LCD Monochrome type
STANDARD FEATURES	:	Anti-nuisance Car Call Protection, Independent Service (for Duplex

## 5) FURNITURE

ITEM NAME	DESCRIPTION
Pushback Auditorium seats	<p>The seat rest assembly to be of 1.2 +/- 0.1 cm thick flat plywood moulded with polyurethane foam &amp; upholstered with 3 layered foam laminated fabric and injection moulded cover. The seat should auto tip off &amp; should fold, when not in use. Seat size to be 45.00 cm W x 48.50 cm D x 14.50 cm T</p> <p>The back rest assembly to be of 1.2 +/- 0.1 cm thick flat plywood upholstered with 3 layered foam laminated fabric, the foam to be designed with contoured lumbar support for extra comfort. Back size of 47.50 cm W x 80.00 cm H x 12.50 cm T</p> <p>The High resilience polyurethane foam for seat &amp; back should be moulded with a density = 48 +/- 2kgs/m<sup>3</sup>.</p> <p>The leg frame assembly is to be fabricated from MS tube of 6.0 +/- 0.03 cm x 4.0 +/- 0.03 cm x 2.0 +/- 0.16 cm welded with a grouting member. It should be black powder coated &amp; should be grouted to the floor using anchors.</p> <p>The armrest assembly should consist of</p> <p>The armrest made up of black integral polyurethane with 65 +/- 10 shore "A" hardness &amp; reinforced with MS insert fixed with leg frame, the armrest should be scratch &amp; weather resistant &amp; should have provision for holding cups. The armrest cladding should be made of 0.9 +/- 0.05 cm thick particle board &amp; upholstered with fabric.</p> <p>All steel parts to be epoxy powder coated with DFT of 40-60 microns.</p>
VIP Sofas -4 Seater (2+2)	<p>The chair consist of the PU Upholstery being the attractive in design for the aesthetic look . Due to upholstery in leather the chair is very comfortable with the density of Foam of 35kgper meter cube . Back and seat is 30mm thickness of the foam all the leg are chrome plated</p>
VIP Sofas -5 Seater	<p>Sofa 3 seater Proving &amp; Fixing 3 seater - Size: 183.0cm(W) x 77.5cm(D) x 74.5cm(H), Seat height (SH): 41.5 cm. LH/RH Side Frame: The LH/Rh side frame is fitted to the two ends of the seat/back mounting frame to form the leg assembly. It is made of SS J4 Grade tube Dia 4.44cm x 1.5mm thick. Seat/Back mounting Frame: the seat/back mounting frame assy. Holds the two side frames together. The mounting frames 2 nos. Are used to connect the side frames. The mounting frame is made of MS. E.R.W. Tube 5.08+<sub>0.03</sub>cm(dia) x 3.15+<sub>0.0252</sub>cm(thk) black painted. The seat/back is mounted on 4.0+<sub>0.03</sub>cm x 2.0+<sub>0.02</sub>cm x 0.2+<sub>0.016</sub>cm M.S. Rectangular tube which is welded on the beam of seat/back mounting frame. Seat/back Assembly : The Seat/back Assemblyconsists of 1.2+<sub>0.1</sub>cm thk plywood insert with polyurethane foam having density 45 +<sub>2</sub> kg/m<sup>3</sup> and the hardness of the P.U. Foam = 18 to 22 kg on Hampden m/c for 25% compression of the foam. The complete moulded seat/back assembly is covered with a replaceable fabric upholstery. The rate shall include all materials, hardware and labour etc. complete as per instruction of engineer-in charge and consultant. Approved Make: Godrej / Herman Miller / Haworth / Knoll</p>
PLU 2 Door Base 1Addon , 4 Door 5 Addon	<p>Providing &amp; Fixing 4 Door Locker Unit - Product Size: 380mm(W) x 450mm(D) x 1830mm(H)</p> <p>Models: 2 Door (Main units), Stackability The add-on units can be stacked width wise to form bank of lockers having common side panel.</p> <p>Locking § 10 Lever cam lock with lock lever,</p> <p>Material: CRCA 0.6mm Thickness</p> <p>Construction: Rigid knockdown construction.</p> <p>Shelf Uniformly Distributed Load Capacity per each shelf level is 35 Kg maximum.</p>



	<p>Finish: Epoxy Polyester Powder coated to the thickness of 50 Microns (+/-10). Handle / Label holder · Aesthetically appealing Snap fit ABS plastic Handle. Plastic label holder for identification  Ventilation Attractive punched pattern for ventilation  Approved Make: Godrej / Herman Miller / Haworth / Knoll</p>
PLU-BASE UNIT	<p>Providing &amp; Fixing 4 Door Locker Unit - Product Size: 380mm(W) x 450mm(D) x 1830mm(H)  Models: 2 Door (Main units), Stackability The add-on units can be stacked width wise to form bank of lockers having common side panel.  Locking § 10 Lever cam lock with lock lever,  Material: CRCA 0.6mm Thickness  Construction: Rigid knockdown construction.  Shelf Uniformly Distributed Load Capacity per each shelf level is 35 Kg maximum.  Finish: Epoxy Polyester Powder coated to the thickness of 50 Microns (+/-10). Handle / Label holder · Aesthetically appealing Snap fit ABS plastic Handle. Plastic label holder for identification  Ventilation Attractive punched pattern for ventilation  Approved Make: Godrej / Herman Miller / Haworth / Knoll</p>
PLU-ADD-ON UNIT	<p>Providing &amp; Fixing 4 Door Locker Unit - Product Size: 380mm(W) x 450mm(D) x 1830mm(H)  Models: 4 Door (Add on units), Stackability The add-on units can be stacked width wise to form bank of lockers having common side panel.  Locking § 10 Lever cam lock with lock lever,  Material: CRCA 0.6mm Thickness  Construction: Rigid knockdown construction.  Shelf Uniformly Distributed Load Capacity per each shelf level is 35 Kg maximum.  Finish: Epoxy Polyester Powder coated to the thickness of 50 Microns (+/-10). Handle / Label holder · Aesthetically appealing Snap fit ABS plastic Handle. Plastic label holder for identification  Ventilation Attractive punched pattern for ventilation  Approved Make: Godrej / Herman Miller / Haworth / Knoll</p>
First Impression with 2 Arc	<p>( Work top)Rubber Wood Top:- Clean matt PU finish 18mm thick Inside radius 700.0 mm Outside radius – 1350.0 mm Depth – 650 mm,Cork:-Rubberized cork – 18mm thick,Glass:-Frosted Glass 10mm thick Diamond cut finishing on edges Inside Radius – 1202.5mm Outside radius – 1402.5 mm Depth – 200mm,Modesty Panel:-MS Perforated sheet Below Worksurface : 0.8 mm (thick) x 665.0 mm (height) x 1345.0 mm (flat length) Above Worksurface : 0.8mm (Thick) x 260 mm (height) x 1345.0 mm (flat length),Legs:-MS tube 1.6 mm thick Diameter 50.8 mm Height 604 mm</p>
Chair for reception Bravo mid back	<p>Medium back chair Proving &amp; Fixing Greenguard certified chair - Product back size : 47.5 cm(W) x 58.0 cm (H) , Seat/Back Assembly : The Seat and back are made up of 1.2 +/- 0.1 cm. Thick hot pressed plywood measured and upholstered with the fabric upholstery covers and moulded polyurethane foam. The back foam is designed with contoured lumber support for extra thick foam on front edge to give comfort to popliteal area. High Resilience(HR) Polyurethane Foam: The HR polyurethane foam is moulded with density 45 +_ 2 kg/m<sup>3</sup> and hardness load 16 +_ 2 kgf as per IS: 7888 for 25% compression. Armrests : The one piece armrests are injection moulded from</p>

	<p>black Co-polymer polypropylene. Centre – Tilt Synchro Mechanism: The mechanism is designed with following features : 360 degree revolving type. Upright position locking. Tilt tension adjustment. Seat/Back tilting ratio of 1:3. Tubular Frame: The powder coated tubular frame is cantilever type &amp; made of 2.54+_ 0.03 cm (dia) x 0.2+_ 0.016 cm (thk). M.S.ER.W. Overall size-763W*763D*855-975H*425-545SH mm. Tube Pneumatic height Adjustment: The pneumatic height adjustment has an adjustment stroke of 12.0+_ 0.3 cm. Telescopic Bellow Assembly : the bellow is 3 piece telescopic tyoe and injection back in polypropylene. Pedestal Assembly : The pedestal is injection moulded in black 33% glass-filled Nylon-66 and fitted with 5 nos. Twin wheel castors. The pedestal is 66.3+_ 0.5 cm. Pitch-center dia.(76.3+_ 1.0 cm with castors). Twin Wheel Castors : The twin wheel castors are injection moulded in black nylon. Tube Pneumatic height Adjustment: The pneumatic height adjustment has an adjustment stroke of 12.0+_ 0.3 cm. The rate shall include all materials, hardware and labour etc. The rate shall include all materials, hardware and labour etc. complete as per instruction of engineer-in charge and consultant.</p>
workstation	<p>Providing &amp; Fixing work station per person - Penta shape with 1500W1*1500W2*600d - 4 equal block based system – BIFMA GOLD LEVEL CERTIFICATION MODEL Providing MS partiton system of 1200 ht . Overall thickness of partition shall be 57 mm ( +/- 5 mm ). panel based work station partition with flexible construction offering various functional and decorative finishes as well as cable management capacity. All trims made of aluminium extrusions. Blocks made out of a composite construction of MDF and paper honeycomb.Panel Blocks made of Fabric Tackable and white board.Tiles should be slid in to the panels from top before fixing the top horizontal. These tiles should be supported from top &amp; bottom side with clips made from PP co polymer fitted in horizontal extrusion. Bottom tile and leg made of Mild steel with epoxy powder coated.Fabricated bottom frame as a welded structure of steel components. The panels and worktops are supported with MS legs with levelers at various locations depending on the layout requirements. Fabric magnetic tiles are fabric upholstered metal tiles in 0.6 mm thick G.I. Grade.Fabric tack tiles are fabric upholstered metal tiles in 0.6 mm thick G.I. Grade, with P.E. Foam in the tile for tack ability / acoustics. The rate shall include all materials, hardware and labour etc. complete as per instruction of engineer-in charge and consultant. Plain Metal tiles are made of 0.6 mm thick M.S. CRCA Grade D as per IS: 513 powder coated with Epoxy- Polyester finish.White board tiles are made of 8.0 mm thick particle board laminated with 0.6mm thick white glossy high pressure laminate on outer side &amp; 0.6mm backing laminate on inner surface and having all its edges with minimum 0.5 mm thick PVC edging. Providing &amp; Fixing work station or equivalent – 4 equal block based system – BIFMA GOLD Certified Model. Providing worktop of 600 mm depth . Work top shall be made of 25mm thick Plain Particle board interior grade conforming to IS:3087:1985 . The top shall be laminated with laminate of 1 mm thickness of approved shade as per IS:2046-1995 and glue of PVAC . Bottom shall have a backing laminate of minimum 0.6 mm thickness. All the edges of work surface shall be provided with machine pressed 2 mm thick PVC lipping glued with hotmelt EVA glue.Worktop to be supported at both end with Peninsular legs.These Legs are made up of M.S. ERW tube of dia 89mm and of 2 mm thickness, pretreated and powder coated with POWDER coating. These are provided with M.S. Level adjuster, for adjustibility upto + 20 mm.Leg base is covered with ABS base cap .Work top shall be mounted onto the partition panels for work stations by means of cantilever brackets made from 2.0 mm thick CRCA grade D steel as per IS:513-1994 duly pretreated and powder coated in black colour. Keyboard Pullout tray shall be of size of 514mm(WIDTH) x 307mm(DEPTH) x 42mm (HEIGHT) made of 0.9 mm thick MS sheet of CRCA Grade 'D' as per IS :513-1994 The said tray shall be mounted on zinc electro plated (as per IS:1573-1996) single extension ball slides. CPU Trolley shall of size - L-225-330 mm , W-225 mm , H-330 mm made of MS 14BG Powder coated 50-60 micron DFT. Providing Free Standing 3 Drawer units .Welded Assembled. Epoxy Polyester</p>

	<p>Powder coated to the thickness of 50 microns (+/-10)..0.8 thk CRCA for Body Shell, Drawer Front &amp; tray, Front Side Stiffener, Rear .Side Stiffener &amp; Bottom,1.2 thk CRCA Top Stiffener &amp; Bottom stiffener.All Drawers with Double extension precision ball slide.10 lever Cam Lock &amp; Central RH locking with actuator &amp; lock channel mechanism for 'Box-File' &amp; '3 Box' Pedestals.Top and front fascia made of 18 thk Wooden (PLB) Straight Edge Top / PVC Lipping on three Edges.Swiveling non-lockable Castors mounted below the body shell.Fifth roller arrangement mounted below File drawer to avoid toppling of unit when file drawer is pulled out. Size : 390 w x 435 d x 656 ht</p>
Chairs	<p>The seat and back are made up of 1.2 cm thick hot pressed plywood, upholstered with fabric and moulded Polyurethane foam with PVC lipping all around. The back foam is designed with contoured lumbar support for extra comfort. SIZE: 65.0cm. (W) X 65.0cm. (D) X 90.0 – 102.5cm(H), SEAT SIZE: 44.0cm. X 56.5m. The polyurethane foam is moulded with density = 45 +/-2 kg/m3 &amp; Hardness = 20 +/- 2 on Hampden machine at 25% compression. The one-piece armrests made of black integral skin polyurethane with 50-70 Shore Hardness and reinforced with M.S. insert. The armrests are scratch and weather resistant. The armrests are fitted to the seat with seat armrest connecting bracket made of 0.3 cm. thk. HR steel. The pneumatic height adjustment has an adjustment stroke of 10 cm. The bellow is 3 piece telescopic type and injection moulded in black Polypropylene. The pedestal is made of moulded plastic (polypropylene) with metal insert and fitted with 5nos. twin wheel castors (castor wheel dia. 5.0cm.). The pedestal is 66.0-cm. pitch-center dia. (76.0 cm with castors). The twin wheel castors are injection moulded in 30% Glass Filled black Nylon.</p>
Filing cabinet	<p>It should have multi bend construction with press fit fasteners free design. It should have roll formed side, back and sides of drawers. It should have 10 lever cam lock. All the drawers should be mounted on nickel chrome plated ball slides. It should have anti tilt mechanism and anti rebound mechanism. All steel components should undergo eight tank anti rust treatment and oven baked epoxy polyester powder coated with 50-60 dry film thickness. The CRCA steel sheet used should be 0.6 mm thick as per IS-513 1994. It should have scratch hardness of 3 Kgs as BS-3900 part E2 1970, IS-101. It should sustain salt spray test of 1000 hrs. as IS 101. Overall size for the 4 Drawer Filing Cabinet: 132 cm (H) x 47 cm (W) x 62 cm (D)</p>
Chairs	<p>Chair Upholstry/Frame : 12 mm hot pressed ply in seat &amp; back cushioned with PU foam and Fabric upholstery  Arms : Chrome plated tube with PU pad  Seat size : 520 mm (w) x 500 mm (D)  Back size : 520 mm (w) x 580 mm (H)  Arms : Upholstered Leatherite Armrest  Base : Silver Metallic Powder Coated/ CR PIPE 25MM Dia Fixed Base</p>
Coffee Table	<p>It should be made of seasoned wood (3" x 3") with dark Mahogany melamine polish. The glass top to be supported on complete rectangular wooden frame, duly polished in mahogany melamine finish. The glass top must have etching work. One additional shelf below the main top Overall size: 45.0 cm (H) x 105.0 cm (W) x 60.0 cm (D)</p>
Reception Counter	<p>Prelaminated Particle Board with 18mm thick table top and 15mm thick understructure covered with PVC Lipping.Locking facility available for top draswer/s only. Attractive Black colour handles for all drawers,Tables are available in Beech colour only</p>

	<p>Model: 1 - Desk with one drawer attachment, Size 1200 x 600 x 750mm</p> <p>Model: 2 - Desk with one drawer &amp; HDU attachment ,Size 1350 x 750 x 750 mm</p> <p>Model: 3 - Desk with one drawer (RHS) &amp; HDU attachment on one side</p> <p>3Desk with one drawer (RHS) &amp; HDU attachment on one side,Size 1500 x 750 x 750mm</p>
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## 6) INTERIOR AND FURNISHING

### i) CURTAIN

Stage Main curtain made of Velvet curtain cloth with horizontal sliding arrangement complete with fixing railing track , fixing brackets ,runner, master runner,3mm rope wire , 1HP Crompton mother , drum with groove cutting pulleys , 2 no air breaker switch for reverse 7 forward 2 no air micro switch for auto stop , 3 no push button for open/stop/close position the curtain should be dropped to half area ,when in closed position and minimum overlap at the center should be 900 mm and curtain should be stitched in double gathering of Appropriate size – 40 feet x 14feet Base price of Velvet cloth to be RS /m2.

Stage Rear curtain made of curtain cloth with horizontal sliding arrangement complete with fixing railing track , fixing brackets ,runner, master runner,3mm rope wire , 1HP Crompton mother , drum with groove cutting pulleys , 2 no air breaker switch for reverse 7 forward 2 no air micro switch for auto stop , 3 no push button for open/stop/close position the curtain should be dropped to half area ,when in closed position and minimum overlap at the center should be 900 mm and curtain should be stitched in double gathering of Appropriate size – 40 feet x 28 feet. Base price of Velvet cloth to be RS /m2.

### ii) FABRIC WALL PANELLING

Supply and installation of Antoni Stretch SLS FR Grade Sol serene fabric system with high-performance integrated core with a white matte face covering, acoustically-transparent textile of size 4/5mx75m, shall be stretched by using combination of GI strut channel framework and GI strut system, wooden base 10mm thick, rigid vinyl Stretch Tracks half wrap 25mm (SE25) and Misdeal 25mm (SE25), strand board, synth PF 10x10 infill with requisite accessories & tools. The GI strut channel Framework includes Floor/ Head (FC50) GI channels having thickness 0.55mm, length 3600mm, equal flanges of 32mm and web of 50mm fixed to floor and ceiling with suitable fasteners at 300mm centres in staggered manner very next to primary panelling. Noise and fire rated silicon sealant to be caulked along the perimeter of the partition frame before fixing channels. Then Stud channel (SC48) having thickness 0.45mm, length 3600mm, unequal flanges of 34/36mm and web of 48mm should be placed into the floor/head channel positioned vertically at 600mm centres. Extra reinforcement to be provided at openings (doors, windows, etc..) The GI strut system includes Cross channel (CC10) having thickness 0.45mm, length 3600mm, knurled web 40, depth 10mm

and equal flanges of 15mm is screw fixed to the GI strut channel Framework behind @ 600mm centers. Wooden base 10mm is then installed on CC10 along the marking lines with metal fasteners inserted at 300mm centers. SE25 tracks to be installed on wooden base, after applying Stick S7 adhesive on both surfaces for a true and continuous secure grip, and heavy-duty fasteners at 150mm centres on one/both sides of Stretch Tracks. Strand square edge magnesite bonded pinewood fibre panels of size 600x1200x20mm having density 400kg/m<sup>3</sup>, weight 8kg is

fixed to CC10 (In between vinyl tracks) with suitable fasteners. Longer edges of panels should be perpendicular to CC10. Synth PF 10x10mm thick adhered on strand panel by using Stick 7 adhesive. The SLS fabric of width 5m is stretched and tucked into the tracks and secure into the locking jaws with tucking tools to obtain smooth, wrinkles free finish. Ensure the cord in the fabric are oriented in one direction to achieve uniform shade.

Note - minimum 50mm additional fabric is required for tucking hence maximum module wall fabric width would be 3900/4900mm.

### Technical Parameters of system

- Core - pinewood fibre & Poly fibre
- Fire – 1 & Class A
- Acoustics – NRC 0.75(system NRC, for 25mm thk Strand C50 mounting)
- Climate (OC RH) – 49, 90
- Termite resistance – Yes
- Light reflectance – Colour dependent
- Green (RC %) – 25

- Hygiene (VoC, Clean room) – Low, Class 1

### iii) HALL CEILINGS

Supply and installation of Antoni Stretch SLS colour FR Grade Sol serene fabric system with high-performance integrated core with a colour matte face covering, acoustically-transparent textile of size 4/5mx75m. Wooden base 10mm is first installed to the C-System (MC45 & CC22) on the marked lines with metal fasteners at 300mm centres embedded in plastic sleeves. Fix SE25 half wrap / full wrap, Misdeal and Track outer corner, rigid FR-PVC high strength extrusions square / bevel edge on the wooden surface by using heavy-duty diverging fasteners at 25mm centres on one/both sides of Stretch Tracks. The ceiling system (C-System) shall include GI Wall channel (WC22) having thickness 0.45mm, length 3600mm, unequal flanges of 20 & 30mm and web of 25mm to be fixed along the perimeters of the wall with nylon sleeves and suitable fasteners at every 300mm centres. Suspended Main channels (MC45) having thickness 0.8mm, length 3600mm, equal flanges of 15mm and web 45mm from the soffit at every 1200mm centres with Suspender angle (SA25) having thickness 0.45mm, length 3600mm, unequal flanges of 25 & 10mm. GI Cross channel (CC25) having thickness 0.45mm, length 3600mm, knurled web of 50mm, depth of 25mm and equal flanges of 9.5mm is fastened to the Main channel (MC45) in the direction perpendicular to the Main Channel (MC45) at every 600mm centres. Antoni Strand board of size 600x1200x20mm thk installed to Strut CC25 by using fasteners, Antoni Synth PF 10x25mm

thick is then adhered on strand board using Stick 7 adhesive. Ensure 5mm air gap between synth PF and SLS fabric. The SLS fabric of width 4/5m is stretched and tucked into the tracks and secure into the locking jaws with tucking tools to obtain smooth, wrinkles free finish. Ensure the cord in the fabric are oriented in one direction to achieve uniform shade.

#### Technical Parameters

- Core Variants - Polyfibre
- Fire – Class A
- Acoustics – NRC up to 1
- Climate (OC RH) – 49, 90
- Termite resistance – Yes
- Light reflectance – Colour dependant
- Green (RC %) – 25
- Hygiene (VoC, Clean room) – Low, Class 1

## 7) Sound system.

### Detailed Specification –

Brand	Model	Device	Specification
Bose	802 IV	Loudspeaker	
		Frequency range	52Hz-15KHz
		Nominal coverage pattern	120 degree horizontal * 100 degree vertical
		Loudspeaker EQ	Active EQ required for optimal performance
		Power handling	240 W
		Sensitivity	92 dB
		Nominal impedance	8 ohms
Bose	MB 12	Subwoofer	
		Frequency response	40Hz – 280Hz
		Nominal Dispersion	Omni directional below 200Hz
		Sensitivity	91 dB SPL
		Long term power handling	400 W
		Nominal impedance	8 ohms
		Loudspeaker EQ	Required

Bose	310 M	Monitor Loudspeakers		
		Frequency response	70Hz- 16kHz	
		Frequency range	55Hz – 19kHz	
		Nominal dispersion	60 degree horizontal * 120 degree vertical	
		Long term power handling	100 W	
		Sensitivity	91 dB SPL	
		Nominal impedance	8 ohm	
Bose	PM 8500	Amplifier		
		Frequency Response	20Hz – 20kHz	
		Signal to Noise ratio	102 dB SPL	
		Loudspeaker EQ	9 band PEQ ( +/- 20db )	
		Maximum output delay	3s	
		Input channels	8 ( balanced line level )	
		Mains voltage	100-240 V	
		Input to Output signal routing	8*8 matrix	
Bose	PM 4500	Amplifier		
		Frequency response	20Hz – 20kHz	



		Signal to Noise ratio	102 dB	
		Input to Output signal routing	4*4 matrix	
		Maximum Output delay	3 s	
		Maximum Input level	+24dBu	
		Mains voltage	100-240V	
Yamaha	Q 2031	Graphic equalizer		
		Frequency response	20Hz – 20kHz	
		Signal to Noise ratio	96dB	
		Total harmonic distortion	0.05%	
		Control range	+/-12dB	
		Gain	+/-0db	
		Output level	1.23V	
Bose	PS 602	Amplifier		
		Frequency response	20Hz-20kHz	
		Channel separation	>85db	
		Signal to noise ratio	100db	
		Input channels	2 unbalanced	

		Maximum power per channel	600W @4-8 ohm	
		Maximum input level	20dBu	
Shure	PGA 48	Wired mic		
		Frequency response	70 to 15000Hz	
		Polar pattern	Cardiod	
		Output Impedance	600ohm	
		Sensitivity	-53.5dbv/pa	
		Type	dynamic	
Shure	SVX 24	Wireless mic		
		Working range	75m ( 250 ft. )	
		Audio channel response	Minimum – 45Hz, Maximum – 15kHz	
		Total harmonic distortion	0.5 percent typical	
		Dynamic range	>100db,A weighted typical	
		RF Level switch	1mW and 10mW	
Shure	SVX 14	Lapel mic		
		Selectable channels	8	
		Audio output	2	

		Frequency response	60 – 20000 Hz	
		Polar pattern	Unidirectional	
		Audio output level	-50Dbv/PA	
		Signal to noise ratio	66dB	
Allen and heath		Mixer		
		XLR Mic/Line inputs 1-16	Balanced , 48V Phantom power	
		Input sensitivity	-60 to +5dBu	
		Input impedance	>5kohm	
		Maximum input level	+19dBu	
		Dynamic range	112 dB	
		Signal to noise ratio	90dB	
Shure	SCM 262	Feedback reducer		
		Frequency response	150Hz – 20kHz	
		Low cut filter	3dB down at80Hz	
		Common mode rejection	>70db at 1kHz	
		Input clipping level	-16dBv	

		Aux input	20Hz – 20kHz	
		Output clipping level	-22dBv	
Epson	EB 2265U	Projector		
		Color output light	5500 lumens – 3800 lumens	
		Resolution	WUXGA ,1920*1200 , 16:10	
		Contrast ratio	15000:1	
		Aspect ratio	16:10	
		High definition	Full HD	
		Lamp	300W, 5000Hrs durability	
	Motorized screen		150" Diagonal 16:10	
	Projector Mount			
	Rack		8U	
	Cables		Speaker Cables	
	Connectors		RCA, Speakon, Neutrik	

## PROCEDURE FOR PARTICIPATION IN E-TENDERING

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### 1. REGISTRATION OF BIDDERS ON E-TENDERING SYSTEM:

All the PWD registered bidders are already registered on the new e-procurement portal <https://www.mpeproc.gov.in>. The user id will be the contractor ID provided to them from MP Online. The password for the new portal has been sent to the bidders registered email ID. for more details may contact M/s. \_Tata Consultancy Services Corporate Block, 5th floor, DB City BHOPAL-462011 email id: [eproc\\_helpdesk@mpsdc.gov.in](mailto:eproc_helpdesk@mpsdc.gov.in). Helpdesk phone numbers are available on website.

### 2. DIGITAL CERTIFICATE:

The bids submitted online should be signed electronically with a Class III Digital Certificate to establish the identity of the bidder submitting the bid online. The bidders may obtain Class III Digital Certificate issued by an approved Certifying Authority authorized by the Controller of Certifying Authorities, Government of India. A Class III Digital Certificate is issued upon receipt of mandatory identity proofs along with an application. Only upon the receipt of the required documents, a Digital Certificate can be issued. For details please visit [cca.gov.in](http://cca.gov.in).

### **NOTE:**

- I. It may take up to 7 working days for issuance of Class III Digital Certificate; hence the bidders are advised to obtain the Certificate at the earliest. Those bidders who already have valid Class III Digital Certificate need not obtain another Digital Certificate for the same. The bidders may obtain more information and the Application Form required to be submitted for the issuance of Digital Certificate from [cca.gov.in](http://cca.gov.in)
- II. Bids can be submitted till bid submission end date. Bidder will require digital signature while bid submission.

The digital certificate issued to the Authorized User of a Partnership firm / Private Limited Company / Public Limited Company and used for online bidding will be considered as equivalent to a no-objection certificate / power of attorney to that user.

In case of Partnership firm, majority of the partners have to authorize a specific individual through Authority Letter signed by majority of the partners of the firm

In case of Private Limited Company, Public Limited Company, the Managing Director has to authorize a specific individual through Authority Letter. Unless the certificate is revoked, it will be assumed to represent adequate authority of the specific individual to bid on behalf of the organization for online bids as per information Technology Act 2000. This Authorized User will be required to obtain a Digital Certificate. The Digital Signature executed through the use of Digital Certificate of this Authorized User will be binding on the firm. It shall be the responsibility of Management / Partners of the concerned firm to inform the Certifying Authority, if the Authorized User changes, and apply for a fresh Digital Certificate for the new Authorized User.

**3. SET UP OF BIDDER'S COMPUTER SYSTEM:**

In order for a bidder to operate on the e-tendering System, the Computer System of the bidder is required to be set up for Operating System, Internet Connectivity, Utilities, Fonts, etc. The details are available at <https://www.mpeproc.gov.in>

**4. KEY DATES:**

The bidders are strictly advised to follow the time schedule (Key Dates) of the bid on their side for tasks and responsibilities to participate in the bid, as all the stages of each bid are locked before the start time and date and after the end time and date for the relevant stage of the bid as set by the Department.

**5. PREPARATION AND SUBMISSION OF BIDS**

The bidders have to prepare their bids online, encrypt their bid Data in the Bid forms and submit Bid of all the envelopes and documents related to the Bid required to be uploaded as per the time schedule mentioned in the key dates of the Notice inviting e-Tenders after signing of the same by the Digital Signature of their authorized representative.

**6. PURCHASE OF BID DOCUMENT**

For purchasing of the bid document bidders have to pay Service Charge online ONLY which is Rs. [as per Bid Date Sheet]. Cost of bid document is separately mentioned in the Detailed NIT. The Bid Document shall be available for purchase to concerned eligible bidders immediately after online release of the bids and up to scheduled time and date as set in the key dates. The payment for the cost of bid document shall be made. online

through Debit/Credit card Net banking or NeFT Challan through the payment gateway provided on the portal.

**7 WITHDRAWAL, SUBSTITUTION AND MODIFICATION OF BIDS**

Bidder can withdraw and modify the bid till Bid submission end date

## **JOINT VENTURE (J.V.)**

J.V. is not allowed as per the conditions of contract.

If J.V. is allowed following conditions and requirements must be fulfilled -

1. Number of partners in a Joint Venture shall not exceed 3 (three). The partners shall comply with the following requirements:
  - a. one of the partners shall be nominated as being Lead Partner, and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners;
  - b. the bid and, in case of a successful bid, the Agreement, shall be signed so as to be legally binding on all partners;
  - c. the partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture and the entire execution of the contract, including payment, shall be done exclusively with the partner in charge;
  - d. all partners of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with the contract terms, and a statement to this effect shall be included in the authorization mentioned under[c] of above, as well as in the bid and in the Agreement in case of a successful bid];
  - e. The joint venture agreement should indicate precisely the role of all members of JV in respect of planning, design, construction equipment key personnel, work execution, and financing of the project. All members of JV should have active participation in execution during the currency of the contract. This should not be varied/modified subsequently without prior approval of the employer;
  - f. The joint venture agreement should be registered, so as to be legally valid and binding on all partners and
  - g. a copy of the joint Venture Agreement entered into by the partners shall be submitted with the bid.
2. The figures for each of the partners of a joint venture shall be added together to determine the Bidder's compliance with the minimum qualifying criteria required for the bid. All the partners collectively must meet the criteria specified in full. Failure to comply with this requirement will result in rejection of the joint venture's bid.
3. The performance security of a joint venture shall be in the name of the partner Lead Partner/joint venture.



4. Attach the power of attorney of the partners authorizing the Bid signatory(ies) On behalf of the joint venture
5. Attach the agreement among all partners of the joint venture [and which is legally binding on all partners], which shows the requirements as indicted in the Instructions to Bidders'.
6. Furnish details of participation proposed in the joint venture as below:

DETAILS OF PARTICIPATION IN THE IOINT VENTURE

PARTICIPATION DETAILS	. FIRM 'A' (Lead Partner)	FIRM 'B'	FIRM 'C'
Financial			
Name of the Banker(s)			
Planning			
construction Equipment			
Key Personnel			
Execution of Work (Give details on contribution of each)			

7. The partners of J.V. should satisfy the qualification criteria as below,
  - a. The Lead Partner must meet at least 50% requirement of Technical and Financial eligibility criteria required for the bid.
  - b. The other partner(s) must meet at least 25% requirement of Technical and financial eligibility criteria required for the bid.
  - c. The lead partner and the other partners should together meet 100% of all the eligibility criteria required for the bid.
8. For the meeting the minimum qualification criteria of experience of similar nature work. Every partner can have experience of different works as defined in similar nature works and together should have the experience of all type of works described in similar nature works.

(See clause 12 of Section 2 —ITB &amp; clause 4 of GCC)

**ORGANIZATIONAL DETAILS****(To be Contained in Envelope- A)**

S.No.	Particulars	Details
1	Registration number issued by Centralized Registration System of Govt. of M.P. or Proof of application for registration.	'(If applicable, scanned copy of proof of application for registration to be uploaded)
2	Valid Registration of bidder in appropriate class through Centralized Registration of Govt. of MP	Registration No. ____ Date____ (Scanned copy of Registration to be uploaded)
3	Name of Organization/ Individual/ Proprietary Firm/Partnership Firm	
4	Entity of Organization Individual/ Proprietary Firm/ Partnership Firm (Registered under Partnership Act)/Limited Company (Registered under the Companies Act—1956)/ Corporation / Joint Venture	
5	Address of Communication	
6	Telephone Number with STD Code	
7	Fax Number with STD Code	
8	Mobile Number	
9	E-mail Address for all communications	
	Details of Authorized Representative	
10	Name	
11	Designation	
12	Postal Address	
13	Telephone Number with STD Code	
14	Fax Number with STD Code	
15	Mobile Number	
16	E-mail Address	

Note:

- In case of partnership firm and limited company certified copy of partnership deed/ Articles of Association and Memorandum of Association along with registration certificate of the company shall have to be enclosed.
- Self-Attested photocopies/scanned copies of all the relevant proof documents should be submitted in the physical bid as well as online bid.

Signature of Bidder with Seal

Date: \_\_\_\_\_

## Envelope — B

### Technical Proposal

**Technical Proposal shall comprise the following documents:**

<b>S.No.</b>	<b>Particulars</b>	<b>Details to be submitted</b>
1	Experience — Financial & Physical	Annexure - I (Format: I-1)
2	Annual Turnover	Annexure - I (Format: I-2)
3	List of technical personnel for the key positions	Annexure - I (Format: I-3)
4	List of Key equipment's/ machines for quality control labs	Annexure - I (Format: I-4)
5	List of Key equipment's/ machines for construction work	Annexure - I (Format: I-5)

Note:

1. Technical Proposal should be uploaded duly page numbered and indexed.
2. Technical Proposal uploaded otherwise will not be considered.

## FINANCIAL & PHYSICAL EXPERIENCE DETAILS

**A. Financial Requirement:**

The bidder should have completed either of the below:

- i) three similar works, each costing not less than the amount equal to 20% of the probable amount of contract during the last 5 financial years; or
- ii) two similar works, each costing not less than the amount equal to 30% of the probable amount of contract during the last 5 financial years; or
- iii) one similar work of aggregate cost not less than the amount equal to 50% of the probable amount of contract in any one financial year during the last 5 financial years;

To be filled in by the contractor:

- i. Details of successfully completed similar works shall be furnished in the following format
- ii. Certificate duly signed by the employer shall also be enclosed for each completed similar work.

Agreement Number & Year	Name of Work	Date of Work Order	Date of Completion	Amount of Contract	Employer's Name and Address

Existing commitments— (Value of 'C' for Bid Capacity formula)

Agreement Number & Year	Name of Work	Date of Work Order	Date of Completion	Amount of Contract	Amount of balance work	Employer's Name and Address

B. Physical Requirement:

Execution of similar items of work in any one financial year during the last 3 financial years should not be less than the minimum physical requirement fixed for the work.

S.No	Particulars	Actual Quantity Executed (To be filled in by the contractor)		
		Year - 1	Year - 2	Year - 3
1	Basement Construction			
2	Concrete work			
S.No	Particulars	Details		
		Project Name	Quantity Executed	Year of Completion
1	Construction of underground structures in (high) water table areas			
2	Construction of Auditorium or large span building works			
3	Comprehensive construction contracts including Civil work, Interior finishing, all allied services such as Fire-fighting sprinkler system, HVAC and MEP and Landscaping			

Note:

1. Certificate duly signed by the employer shall be enclosed for the actual quantity executed in any one year during the last 3 financial years,
2. Similar works: The similarity shall be based on the physical size, complexity, methods technology or other characteristics of main items of work viz, earth work, cement concrete, Reinforced cement concrete, brick masonry, stone masonry etc.

## ANNUAL TURN OVER

**Requirement:**

Average annual construction turnover on the construction works not less than 50% of the probable amount of contract during the last 3 financial years;

**To be filled in by the contractor:**

Financial Year	Payments received for contracts in progress or completed
1	
2	
3	

Note:

- i Annual turnover of construction should be certified by the Chartered Accountant.
- ii. Audited. balance sheet including all related notes, and income statements for the above financial years to be enclosed.

**Bid Capacity**

Applicants who meet the minimum qualifying criteria in the evaluation as stated above are to be evaluated further for bid capacity as under:

$$\text{Bid Capacity} = (1.5A \times B) - C$$

Where

- A. = Maximum value of civil engineering works executed in any one year during the last five year (10% weightage per year shall be given to bring the value of work executed at present price level)
- B = Proposed contract period in years.
- C = Amount of work in hand at present.

## List of Technical Personnel for the Key Positions

Minimum requirement							Available with the bidder						
S.No.	Key Position	Minimum requirement	Qualification	Age	Similar work experience	Total Work Experience	S.No.	Name of Personnel	Key Position	Qualification	Age	Similar work experience	Total Work Experience
1	Engineer	1	B.E. Civil	Below 65	5 years	Full Time							
2	Technologist	1	Diploma Civil	Below 65	5 years	Full Time							
3	Technologist	1	Diploma E/M	Below 65	5 years	As and When required							



## List of Key Equipment's for Quality Control Labs

Minimum requirement			Available with the bidder	
S. No.	Name of Equipment/ Machinery	Quantity	Name of Equipment/ Machinery	Quantity
1.	Balances i) 7 Kg. To 10 Kg. Capacity. Semi-Self Indicating type- Accuracy 10 gm. ii) 500 gm. Capacity, Semi-Self indicating type- Accuracy 1 gm. iii) Pan Balance- 5 Kg. Capacity, Accuracy 10 gm	1 set		
2	Ovens-Electrically operated, thermostatically controlled up to 110 G. Sensitivity 1C	1 set		
3	Sieves: As per IS 460-1962. i) I.S. Sieves- 450 mm internal dia of sizes 100 mm, 80 mm, 63 mm. 50 mm, 40 mm, 25 mm, 20 nun,	1 set		

	<p>12.5 mm, 10 mm, 6.3 mm. 4.75 mm complete with lid and pan.</p> <p>ii) IS Sieves- 200 mm internal dia. (brass frame) consisting of 2.36 mm, 1.18 mm, 600 microns, 425 microns, 300 microns, 212 microns, 150 microns, 90 microns, 75 microns with lid and pan.</p>			
4	Sieve shaker capable of 200 mm and 300 mm dia sieves, manually operated with timing switch assembly.	1 set		
5	Equipment for slump test-Slump Cone, steel plate tamping rod, steel scale scoop	1 set		
6	Dial gauges 25 mm travel- 0.01 mm/division. Least count	1 set		
7	100 tones compression testing machine, electrical-cum manually operated.	1 set		
8	Graduated	1 set		

	measuring cylinders 200 ml capacity - 3 Nos.			
9	Enamel trays (for efflorescence test for bricks) 1) 300mm X 250 mm X 40 mm - 2 Nos. ii. Circular plates of 250 mm dia - 4 Nos.	1 set		

## List of Key Machines for Construction Work

Minimum requirement			Available with the bidder	
S. No	Name of Equipment/ Machinery	Quantity	Name of Equipment/ Machinery	Quantity
1	Concrete Mechanical Mixer With Hooper	3 nos		
2	Concrete weigh hatcher minimum 30 cubic meter capacity	2 nos		
3	Plate Vibrator	4 nos		
4	Diesel/Electric pin Vibrator	4 nos		
5	Curing pump of 1.5 hp capacity with set of pipe	3 nos		
6	Steel centering plates/centering pipes	1000 sqm		
7	Auto label instrument	1 nos		

## FINANCIAL BID

### (To Be Contained in Envelope-C)

NAME OF WORK \_\_\_\_\_

I/We hereby bid for the execution of the above work within the time specified at the rate (in figures) \_\_\_\_\_ (in words) \_\_\_\_\_ percent below/ above / at par based on the Bill of Quantities and item wise rates given therein in all respects and in accordance with the specifications, designs, drawings and instructions in writing in all respects in accordance with such conditions so far as applicable. I/We have visited the site of work and am/are fully aware of all the difficulties and conditions likely to affect carrying out the work. I/We have fully acquainted myself/ourselves about the conditions in regard to accessibility of site and quarries/kilns, nature and the extent of ground, working conditions including stacking. of materials, installation of tools and plant conditions effecting accommodation and movement of labour etc. required for the satisfactory execution of contract.

Should this bid be accepted, I/We hereby agree to abide by and fulfill all the terms and provisions of the said conditions of contract annexed- hereto so far as applicable, or in default thereof to forfeit and pay to the Jabalpur Smart City Limited or his successors in office the sums of money mentioned in the said conditions.

#### Note:

- i. Only one rate of percentage above or below or at par based on the Bill of Quantities and item wise rates. given therein shall be quoted.
- ii. Percentage shall be quoted in figures as well as in words. If any difference in figures and words is found lower of the two shall be taken as valid and correct rate. If the bidder is not ready to accept such valid and correct rate and declines to furnish performance -security and sign the agreement his earnest money deposit shall be forfeited.
- iii. In case. the percentage "above" or "below" is not given by a bidder, his bid shall be treated as non-responsive.
- iv. All duties, taxes, and other levies payable **(INCLUDING G.S.T.)** by the bidder shall be included in the percentage quoted by the bidder.

Signature of Bidder

Name of Bidder

The above bid is hereby accepted by me on behalf of the Jabalpur Smart City Limited dated the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_

Signature of Officer  
by whom accepted

**MATERIALS TO BE ISSUED BY THE DEPARTMENT**

NIL

**LETTER OF ACCEPTANCE (LOA)**

No. \_\_\_\_\_

Dated: \_\_\_\_\_

To,

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

(Name and address of the contractor)

Subject: \_\_\_\_\_

(Name of the work as appearing in the bid for the. work)

Dear Sir(s),

Your bid for the work mentioned above has been accepted on behalf of the Jabalpur Smart City Limited at your bided percentage \_\_\_\_\_ below/ above or at par the Bill of Quantities and item wise rates given therein.

You are requested to submit within 15 (Fifteen) days from the date of issue of this letter:

- a. The performance security/ performance guarantee of Rs. \_\_\_\_\_ (in-figures) (Rupees \_\_\_\_\_ in words only). The performance security shall be in the shape of term deposit receipt / bank guarantee of any nationalized / schedule commercial bank valid up to three months after the expiry of defects liability period.
- b. Sign the contract agreement.

Please note that the time allowed for carrying-out the work as entered in the bid is \_\_\_\_\_ months including/ excluding rainy season, shall be reckoned from the date of signing the-contract agreement.



Signing the contract agreement shall be reckoned as intimation to commencement of work and no separate letter for commencement of work is required. Therefore, after signing of the agreement, you are directed to contact the Engineer-in-charge for taking the possession of site and necessary instructions to start the work.

Yours Faithfully

Executive Engineer

## **PERFORMANCE SECURITY**

To

\_\_\_\_\_ [name of Employer]  
\_\_\_\_\_ [address of Employer]

WHEREAS \_\_\_\_\_ [name and address of Contractor] (Hereinafter called 'the Contractor') has undertaken, in pursuance of letter of Acceptance No- \_\_\_\_\_ dated to execute \_\_\_\_\_ [name of Contract and brief description of Works] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligation in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, Up to a total of \_\_\_\_\_ [amount of guarantee]\* \_\_\_\_\_ (in words), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and Without cavil or argument, an sum or sums within the limits of \_\_\_\_\_ [amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

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

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

This guarantee shall be valid until 3 (three) months from the date of expiry of the Defect Liability Period.

Signature, Name and Seal of the guarantor \_\_\_\_\_

Name of Bank \_\_\_\_\_

Address \_\_\_\_\_

Phone No, Fax No., E-mail Address, of Signing Authority \_\_\_\_\_

Date \_\_\_\_\_

\*An amount shall be inserted by the Guarantor, representing the percentage the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees.

## SECTION 3

### Conditions of Contract

#### Part - I General Conditions of Contract [GCC]

**Table of Clauses of GCC**

Clause No.	Particulars	Clause No.	Particulars
<b>A. General</b>		21	Payments for Variations and / or Extra Quantities
1	Definitions	22	No compensation for alterations in or restriction of work to be carried out.
2	Interpretations and Documents	23	No Interest Payable
3	Language and Law	24	Recovery from Contractors
4	Communications	25	Tax
5	Subcontracting	26	Check Measurements
6	Personnel	27	Termination by Engineer in Charge
7	Force Majeure	28	Payment upon Termination
8	Contractor's Risks	29	Performance Security
9	Liability For Accidents To Person	30	Security Deposit
10	Contractor to Construct the Works	31	Price Adjustment
11	Discoveries	32	Mobilization and Construction Machinery Advance
12	Dispute Resolution System	33	Secured Advance
<b>B Time Control</b>		34	Payments Certificates
13	Programme	<b>E. Finishing the Contract</b>	
14	Extension of Time	35	Completion Certificate
15	Compensation for Delay	36	final Account
16	Contractor's quoted percentage	<b>F. Other Conditions of Contract :</b>	
<b>C. Quality Control</b>		37	Currencies
17	Tests	38	Labour

18	Correction of Defects noticed during the Defect Liability Period	39	Compliance with Labour Regulations
<b>D. Cost Control</b>		40	Audit and Technical Examination. —
19	variations.- Change in original Specifications, Designs, Drawings etc.	41	Death or Permanent Invalidity of Contractor
20	Extra Items .	42	.Jurisdiction

## A. General

### 1. DEFINITIONS

- 1.1. **Bill of Quantities:** means the priced and completed Bill of Quantities forming part of the Bid.
- 1.2. **Chief Engineer:** means Chief Engineer of the zone/ basin concerned:
- 1.3. **Completion:** means completion of the work as certified by the Engineer-in-Charge, in accordance with provisions of agreement.
- 1.4. **Contract:** means the Contract between the Employer and the Contractor to execute, complete and/or maintain the work. Agreement is synonym of Contract and carries the same meaning wherever used.
- 1.5. **Contract Data:** means the documents and other information, which comprise of the Contract.
- 1.6. **Contractor:** means a person or legal entity whose bid to carry out the work has been accepted by the Employer.
- 1.7. **Contractor's bid:** means the completed bid document submitted by the Contractor to the Employer.
- 1.8. **Contract amount:** means the amount of contract worked out on the basis of accepted bid.
- 1.9. **Completion of work:** means completion of the entire contracted work; Exhaustion of quantity of any particular item mentioned in the bid document shall not imply completion of work or any component thereof.
- 1.10. **Day:** means the calendar day.
- 1.11. **Defect:** means any part of the work not completed in accordance with the specifications included in the contract.
- 1.12. **Department:** means Department of the, State Government viz. Water Resources Department, Public Works Department, Public Health Engineering Department Rural Engineering Service and any other organization which adopts this document.
- 1.13. **Drawings:** means drawings including calculations and other information provided or approved by the Engineer-in-Charge.
- 1.14. **Employer:** means the party as defined in the Contract Data, who employs the Contractor to carry out the work. The Employer may delegate any or all functions to a person or body nominated by him for specified functions. The word Employer / Government / Department wherever used denote the Employer.
- 1.15. **Engineer:** means the person named in the Contract Data.
- 1.16. **Engineer in charge:** means the person named in the Contract Data.

- 1.17. **Equipment:** means the Contractor's machinery and vehicles brought temporarily to the Site for execution of work.
- 1.18. **Government:** means Government of Madhya Pradesh.
- 1.19. **In Writing:** means communicated in written form and delivered against receipt.
- 1.20. **Material:** means all supplies, including consumables, used by the Contractor for incorporation in the work.
- 1.21. **Superintending Engineer:** means Superintending Engineer-in-Charge of the Circle concerned.
- 1.22. **Stipulated period of completion:** means the period in which the Contractor is required to complete the work. The stipulated period is specified in the Contract Data.
- 1.23. **Specification:** means the specification of the work included in the Contract and any modification or addition made or approved by the Engineer-in-Charge.
- 1.24. **Start Date:** means the date of signing of agreement for the work.
- 1.25. **Sub-Contractor:** means a person or corporate body who has a Contract with the Contractor, duly authorized to carry out a part of the construction work under the Contract.
- 1.26. **Temporary Work:** means work designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the work.
- 1.27. **Tender/Bid, Tendered/Bidder:** are the synonyms and carry the same meaning where ever used. -
- 1.28. **Variation:** means any change in the work which is instructed or approved as variation under this contract.
- 1.29. **Work:** The expression "work" or "works" where used in these conditions shall unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the work by virtue of contract, contracted to be executed, whether temporary or permanent and whether original, altered, substituted or additional,

## **2. INTERPRETATIONS AND DOCUMENTS**

### **2.1 Interpretations**

In the contract, except where the context requires otherwise:

- a. words indicating one gender include all genders;
- b. Words indicating the singular also include the plural and vice versa.
- c. provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing;

- d. written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record;

## **2.2 Documents Forming Part of Contract:**

1. NIT with all amendments.
2. Instructions to Bidders (ITB, Bid Data Sheet with all Annexure's)
3. Conditions of Contract:
  - i. Part I General Conditions of Contract and the Contract Data; with all Annexures
  - ii. Part II Special Conditions of Contract.
4. Specifications
5. Drawings
- 6 Bill of Quantities
7. Technical and Financial Bid
8. Agreement, and
9. Any other document(s), as specified.

## **3. Language and Law**

The language of the Contract and the law governing the Contract are stated in the Contract Data

## **4. Communications**

All certificates, notice or instruction to be given to the Contractor by Employer/Engineer shall be sent to the address or contact details given by the Contractor in [Annexure H of ITB]. The address and contact details for communication with the Employer/Engineer shall be as per the details given in the Contract Data. Communication between parties that are referred to in the conditions shall be in writing. The notice sent by facsimile (fax) or other electronic means (email) shall also be effective on confirmation of the transmission. The notice sent by registered post or speed post shall be effective on delivery or at the expiry of the normal delivery period as undertaken by the postal service. In case of any change in address for communication, the same shall be immediately notified to Engineer-in- Charge.

## **5. Subcontracting**

Subcontracting shall be permitted for contracts of value more than amount specified in the Contract Data with following conditions.



- a. The Contractor may subcontract up to 25 percent of the contract price with the approval of the Employer in writing, but will not assign the Contract. Subcontracting shall not alter the Contractors obligations.
- b. Following shall not form part of subcontracting:
  - i. Hiring of labour through a labour contractor.
  - ii. The purchase of Materials to be incorporated in the works.
  - iii. Hiring of plant& machinery. .
- c. The sub-contractor will have to be registered in the appropriate category in the centralized registration system for contractors of the GOMP.

## **6. Personnel**

- 6.1 The Contractor shall employ for the construction work and routine maintenance the technical personnel as provided in the Annexure I-3 of Bid Data Sheet if applicable. If the Contractor fails to deploy required number of technical staff, recovery as specified in the Contract Data will be made from the Contractor.
- 6.2 If the Engineer asks the Contractor to remove a person who is a member of the contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within three days and has no further connection with the Works in the Contract.

## **7. Force Majeure**

7.1 The term "Force Majeure" means an exceptional event or circumstance:

Which is beyond a Party's control,

Which such Party could not reasonably have provided against before entering into the Contract

Which, having arisen, such Party could not reasonably have avoided or overcome, and

Which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

- i. War, hostilities (whether war be declared or not), invasion, act of foreign enemies,

- ii. Rebellion, terrorism, sabotage by persons other than the contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,
  - iii. Riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,
  - iv. Munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and
  - v. Natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.
- 7.2. In the event of either party being rendered unable by force majeure to perform any duty or discharge any responsibility arising out of the contract, the relative obligation of the party affected by such force majeure shall upon notification to the other party be suspended for the period during which force majeure event lasts. The cost and loss sustained by either party shall be borne by respective parties.
- 7.3. For the period of extension granted to the Contractor due to Force Majeure the price adjustment clause shall apply but the penalty clause shall not apply. It is clarified that this sub clause shall not give eligibility for price adjustment to contracts which are otherwise not subject to the benefit of price adjustment clause.
- 7.4. The time for performance of the relative obligation suspended by the force majeure shall stand extended by the period for which such cause lasts. Should the delay caused by force majeure exceed twelve months, the parties to the contract shall be at liberty to foreclose the contract after holding mutual discussions.

## **8. Contractor's Risks -**

- 8.1 All risks of loss or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract are the responsibility of the Contractor.
- 8.2 All risks and consequences arising from the inaccuracies or falseness of the documents, drawing, designs, other documents and/or information submitted by the contractor shall be the responsibility of the Contractor alone, notwithstanding the fact that the design/ drawings or other documents have been approved by the department.

## **9. Liability for Accidents to Person**

The contractor shall be deemed to have indemnified and saved harmless the Corporation against all action, suits, claims, demands, costs etc. arising in connection

with injuries suffered by any persons employed by the contractor or his subcontractor for the works whether under the General law or under workman's compensation Act or any other statute in force at the time of dealing with the question of the liability of employees for the injuries suffered by employees and to have taken steps properly to ensure against any claim there under.

#### **10. Contractor to Construct the Works**

- 10.1 The Contractor shall construct install and maintain the Works in accordance with the Specifications and Drawings as specified in the Contract Data.
- 10.2 In the case of any class of work for which there is no such specification as is mentioned in Contract Data, such work shall be carried out in accordance with the instructions and requirement of the Engineer-in-charge.
- 10.3 The contractor shall supply and take upon himself the entire responsibility of the sufficiency of the scaffolding, timbering, machinery, tools and implements, and generally of all means used for the fulfillment of this contract whether such means may or may not be approved or recommended by the Engineer.

#### **11. Discoveries**

Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

#### **12. Dispute Resolution System**

- 12.1 No dispute can be raised except before the Competent Authority as defined in Contract Data in writing giving full description and grounds of dispute. It is clarified that merely recording protest while accepting measurement and/or payment shall not be taken as raising a dispute.
- 12.2 No dispute can be raised after 45 days of its first occurrence. Any dispute raised after expiry of 45 days of its first occurrence shall not be entertained and the Employer shall not be liable for claims arising out of such dispute.
- 12.3 The Competent Authority shall decide the matter within 45 days.
- 12.4 Appeal against the order of the Competent Authority can be preferred within 30 days to the Appellate Authority as defined in the Contract Data. The Appellate Authority shall decide the dispute within 45 days.

12.5 Appeal against the order of the Appellate Authority can be preferred before the Madhya Pradesh Arbitration Tribunal constituted under Madhya Pradesh *Madhyastham Adhikaran Adhiniyam, 1983*.

12.6 The Contractor shall have to continue execution of the Works with due diligence notwithstanding pendency of a dispute before any authority or forum.

## **B. Time Control**

### **13. Programme**

13.1 Within the time stated in the Contract Data, the Contractor shall submit to the Engineer for approval a Programme showing the general methods arrangements, order and timing for all the activities for the construction of works.

13.2 **The program shall be supported with all the details regarding key personnel, equipment and machinery proposed to be deployed on the works for its execution.** The contractor shall submit the list of equipment and machinery being brought to site, the list of key personnel being deployed, the list of machinery/equipment being placed in field laboratory and the location of field laboratory along with the Programme.

13.3 An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining Works, including any changes to the sequence of the activities.

13.4 The Contractor shall submit to the Engineer for approval an updated Programme at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Programme within this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Programme has been submitted.

13.5 The Engineer's approval of the Programme shall not alter the Contractor's obligations.

### **14. Extension of Time**

14.1. If the Contractor desires an extension of time for completion of the work on the ground of his having been unavoidably hindered in its execution or on any other

grounds, he shall apply, in writing, to the Engineer-in-charge, on account of which he desires such extension. Engineer-in-Charge shall forward the aforesaid application to the Competent Authority as prescribed.

- 14.2 The competent authority shall grant such extension at each such occasion within a period of 30 days of receipt of application from contractor and shall not wait for finality of work. Such extensions shall be granted in accordance with provisions under clause 15 of this agreement.
- 14.3 In case the work is already in progress, the Contractor shall proceed with the execution of the works, including maintenance thereof, pending receipt of the decision of the competent authority as aforesaid with all due diligence.

## **15. Compensation for delay**

- 15.1 The time allowed for carrying out the work, as entered in the agreement, shall be strictly observed by the Contractor.
- 15.2 The time allowed for execution of the contract shall commence from the date of signing of the agreement. It is clarified that the need for issue of work order is dispensed with.
- 15.3 In the event milestones are laid down in the Contract Data for execution of the works, the contractor shall have to ensure strict adherence to the same.
- 15.4 Failure of the Contractor to adhere to the timelines and/or milestones shall attract such liquidated damages as is laid down in the Contract Data.
- 15.5 In the event of delay in execution of the Works as per the time lines mentioned in the Contract Data the Engineer-in-charge shall retain from the bills of the Contractor amount equal to the liquidated damages leviable until the Contractor makes such delays good. However, the Engineer-in-charge shall accept bankable security in lieu of retaining such amount.
- 15.6 If the Contractor is given extension .of time after liquidated damages have been paid, the Engineer in Charge shall correct any over payment of liquidated damages by the Contractor in the next payment certificate.
- 15.7 In the event the Contractor fails to make good the delay until completion of the stipulated contract period (including extension of time) the sum so retained shall be adjusted against the liquidated damages levied.

**16. Contractor's quoted percentage**

The Contractor's quoted percentage rate referred to in the "Bid for works" will be deducted added from/to the net amount of the bill after deducting the cost of material supplied by the department.

**C. Quality Control**

**17. Tests**

17.1 The Contractor shall be responsible for:

- a. Carrying out the tests prescribed in specifications, and
- b. For the correctness of the test results, whether performed in his laboratory or elsewhere.

17.2 The contractor shall have to establish field laboratory within the time specified and having such equipment's as are specified in the Contract Data.

17.3 Failure of the Contractor to establish laboratory shall attract such penalty as is specified in the Contract Data.

17.4 Ten percent of the mandatory test prescribed under the specification shall be got carried out through laboratories accredited by national Accreditation Board of laboratories (NABL) By the Engineer-in-charge and the cost of such testing shall be deducted from the payments due to contractor .

**18. Correction of Defects noticed during the Defect Liability Period**

18.1 The Defect Liability Period of work in the contract shall be as per the Contract Data.

18.2 The Contractor shall promptly rectify all defects pointed out by the Engineer well before the end of the Defect Liability Period. The Defect Liability Period shall automatically stand extended until the defect is rectified.

18.3 If the Contractor has not corrected a Defect pertaining to the Defect Liability Period to the satisfaction of the Engineer, within the time specified by the Engineer, the Engineer will assess the cost of having the Defect corrected, and the cost of correction of the Defect shall be recovered from the Performance Security or any amount due or that may become due to the contractor and other available securities.

**D. COST CONTROL**

**19. Variations - Change in original Specifications, Designs, and Drawings etc.**

- 19.1 The Engineer-in-charge shall have power to make any alterations, omissions or additions to or substitutions in the original specifications, drawings, designs and instructions, that may appear to him to be necessary during the progress of the work and the contractor shall carry out the work in accordance with any instructions which may be given to him in writing signed by the Engineer-in-charge, and such alterations, omission, additions or substitutions shall not invalidate the contract and any altered, additional or substituted work, which the contractor may be directed to do in the manner above specified, as part of the work, shall be carried out by the contractor on the same conditions in all respects on which he agrees to do the main work.
- 19.2 The time for the completion of the work shall be adjusted in the proportion that the altered, additional or substituted work bears to the original contract work and the certificate of the Engineer-in-charge shall be conclusive as to such proportion.

**20. Extra items**

- 20.1 All such items which are not included in the priced BOQ shall be treated as extra items.

**21. Payments for Variations and / or Extra Quantities**

- 21.1 The rates for such additional (Extra quantity), altered or substituted work / extra items under this clause shall be worked out in accordance with the following provisions in the irrespective order:
- a. The contractor is bound to carry out the additional (Extra quantity), work at the same rates as are specified in the contract for the work.
  - b. If the item is not in the priced BOQ and is included in the SOR of the department, the rate shall be arrived at by applying the quoted tender percentage on the SOR rate.
  - c. If the rates for the altered or substituted work are not provided in applicable SOR - such rates will be derived from the rates for a similar class (type) of work as is provided in the contract (priced BOQ) for the work.

- d. If the rates for the altered, substituted work cannot be determined in the manner specified in the sub clause (c) above - then the rates for such composite work item shall be worked out on the basis of the concerned Schedule of Rates minus/plus the percentage quoted by the contractor.
- e. If the rates for a particular part or parts of the item is not in the Schedule of Rates and the rates for the altered, or substituted work item cannot be determined in the manner specified in sub clause (b) to (d) above, the rate for such part or parts will be determined by the Competent Authority, as defined in the Contract Data on the basis of the rate analysis derived out of prevailing market rates when the work was done.
- f. But under no circumstances, the contractor shall suspend the work on the plea of non-acceptability of rates on items falling under sub clause (a) to (d). In case the contractor does not accept the rate approved by the Engineer in Charge for a particular item, the contractor shall continue to carry out the item at the rates determined by the Competent Authority. The decision on the final rates payable shall be arrived at through the dispute settlement procedure.

**22. No compensation for alterations in or restriction of work to be carried out.**

22.1. If at any time after the commencement of the work, the Engineer-in-charge for any reason whatsoever, not require the whole or any part of the work as specified in the bid to be carried out the Engineer-in-charge shall give notice in writing of the fact to the Contractor and withdraw that whole or any part of the work.

22.2 The Contractor shall have no claim to any payments or compensation whatsoever, on account of any profit or advantage which he might have derived from the execution of work in full or on account of any loss incurred for idle men and machinery due to any alteration or restriction of work for whatsoever reason.

22.3 The Engineer-in-charge may supplement the work by engaging another agency to execute such portion of the work, without prejudice to his rights.

**23. 'No Interest Payable**

No interest shall be payable to the Contractor on any payment due or awarded by any authority.



## **24. Recovery from Contractors**

Whenever any claim against the Contractor for the payment arises under the contract, the Department may be entitled to recover such sum by:

- (a) Appropriating, in part or whole of the Performance Security and Additional Performance Security, if any; and/or Security Deposit and / or any sums payable under the contract to the contractor.
- (b) If the amount recovered in accordance with (a) above is not sufficient, the balance sum may be recovered from any payment due to the contractor -under any other contract of the department, including the securities which become due for release.
- (c) The department shall, further have an additional right to effect recoveries as arrears of land revenue under the M.P. Land-Revenue Code.

## **25. Tax -**

- 25.1 The rates quoted by the Contractor shall be deemed to be inclusive of the commercial tax and other levies, duties, cess, toll, taxes of Central and State Governments, local bodies and authorities,
- 25.2 The liability, if any, on account of quarry fees, royalties, octroi and any other taxes and duties in respect of materials actually consumed on public work, shall be borne by the Contractor.
- 25.3 Any changes in the taxes due to change in legislation or for any other reason shall not be payable to the contractor.

## **26. check Measurements**

- 26.1 The department reserves to itself the right to prescribe a scale of check measurement of work in general or specific scale for specific works or by other special orders.
- 26.2 Checking of measurement by superior officer shall supersede measurements by subordinate officer(s), and the former will become the basis of the payment.
- 26.3 Any over/excess payments detected, as a result of such check measurement or otherwise at any stage up to the date of completion of the defect liability period specified in this contract, shall be recoverable from the Contractor, as per clause 24 above.

## **27. Termination by Engineer in charge**

- 27.1 If the Contractor fails to carry out any obligation under the Contract, the Engineer in Charge may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.
- 27.2 The Engineer in Charge, shall be entitled to terminate the Contract if the Contractor

- a) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract;
- b) the Contractor is declared as bankrupt or goes into liquidation other than for approved reconstruction or amalgamation;
- c) without reasonable excuse falls to comply with the notice to correct a particular defect within a reasonable period of time;
- d) the Contractor does not maintain a valid instrument of financial security as prescribed;
- e) the Contractor has delayed the completion of the Works by such duration for which the maximum amount of liquidated damages is recoverable;
- f) If the Contractor fails to deploy machinery and equipment or personnel or set up a field laboratory as specified in the Contract Data;
- g) If the contractor, in the judgment of the Engineer in charge has engaged in corrupt or fraudulent practices in competing for or in executing the contract;
- h) Any other fundamental breaches as specified in the Contract Data.

27.3 In any of these events or circumstances, the Engineer in Charge may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site, However, in the case of sub-paragraph (b) or (g) of clause 27.2, the Engineer in Charge may terminate the Contract immediately.

27.4 Notwithstanding the above, the Engineer-in-Charge may terminate the Contract for convenience by giving notice to the Contractor.

## **28. Payment upon Termination**

28.1 If the contract is terminated under clause 27.3, the Engineer shall issue a certificate for value of the work accepted on final measurements, less Advance Payments and Penalty as indicated in the Contract Data. The amount so arrived at shall be determined by the Engineer-in-Charge and shall be final and binding on both the parties.

28.2 Payment on termination under clause 27.4 above -

If the Contract is terminated under clause 27.4 above, the Engineer shall issue a certificate for the value of the work done, the reasonable cost of removal of Equipment, repatriation, of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.

28.3 If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be recovered as per clause 24 above.

## **29. Performance Security**

The Contractor shall have to submit, performance security and additional performance security, if any, as specified in the Bid Data Sheet at the time of signing of the contract. The contractor shall have to ensure that such performance security and additional performance security, if any remains valid for the period 'as specified in the Contract Data.

## **30. Security Deposit-**

30.1 Security Deposit shall be deducted from each running bill at the rate as specified in the Contract Data. The total amount of Security Deposit so deducted shall not exceed the percentage of Contract Price specified in the Contract Data.

30.2 The security deposit may be replaced by equivalent amount of bank guarantee or fixed deposit receipt assigned to the Employer, with validity up to 3 (three) months beyond the completion of Defect Liability Period/ extended Delectability Period.

30.3 The Security Deposit shall be refunded on completion of' Defect Liability Period.

## **31. Price Adjustment**

### **31.1 Applicability**

1. Price adjustment shall be applicable only if provided for in the Contract Data.
2. The price adjustment clause shall apply only for the works executed from the date of signing of the agreement until the end of the initial intended completion date or extensions granted for reasons attributed to the Employer by the Engineer.
3. The Contractor shall not be entitled to any benefit arising from the price adjustment clause for extension in the contract period for reasons attributed to the Contractor.
4. In the Force Majeure event the price escalation clause shall apply.

### **31.2 Procedure**

1. Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with following principles and procedures and as per formula given in the contract data.
2. The price adjustable shall be determined during each quarter from the formula given in the contract data.
3. Following expression and meaning are assigned to the work done during each quarter:

R = Total value of work during the quarter. It would include the amount of secured advance granted, if any, during the quarter, less the amount of secured advance recovered, if any during the quarter, less value of material issued by the department, if any, during the quarter.

4. Weightages of various components of the work shall be as per the Contract Data.

**31.3** To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clauses in the contract the unit rates and prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

**31.4** The index relevant to any quarter, for which such compensation is paid, shall be the arithmetical average of the indices relevant of the calendar month.

**31.5** For the purpose of clarity it is pointed out that the price adjustment may be either positive or negative, i.e. if the price adjustment is in favour of the Employer, the same shall be recovered from the sums payable to the Contractor.

## **32. Mobilization and Construction Machinery Advance**

32.1 Payment of advances shall be applicable if provided in the Contract Data.

32.2 If applicable, the Engineer in Charge shall make interest bearing advance payment to the contractor of the amounts stated in the Contract Data, against provision by the contractor of an unconditional Bank Guarantee in a form and by a nationalized/scheduled banks, in the name as stated in the Contract Data in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the contractor.

32.3 The rate of interest chargeable shall be as per Contract Data.

32.4 The construction machinery advance, if applicable, shall be limited to 80% of the cost of construction machinery and admissible only for new construction machinery.

32.5 The advance payment shall be recovered as stated in the Contract Data by deducting proportionate amounts from payment otherwise due to the Contractor. No account shall be taken of the advance payment or its recovery in assessing

valuations of work done, variations, price adjustments, compensation events, or liquidated damages.

### **33. Secured Advance**

- 33.1 Payment of Secured Advance shall be applicable if provided in the Contract Data.
- 33.2 If applicable, the Engineer shall make advance payment against materials intended for but not yet incorporated in the Works and against provision by the contractor of an unconditional Bank Guarantee in a form and by a nationalized/ scheduled bank, in the name as stated in the Contract Data, in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been adjusted, but the amount of the guarantee shall be progressively reduced by the amounts adjusted by the contractor.
- 33.3 The amount of secured advance and conditions to be fulfilled shall be as stipulated in the Contract Data.
- 3.4 The Secured Advance paid shall be recovered as stated in the Contract Data.

### **34. Payment Certificates**

The payment to the contractor will be as follows for construction work:

- (a) The Contractor shall submit to the Engineer monthly statements of the value of the work executed less the cumulative amount certified previously, supported with detailed measurement of the items of work executed.
- (b) The Engineer shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.
- (c) The value of work executed shall be determined, based on the measurements approved by the Engineer/ Engineer-in-charge.
- (d) The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed:
- (e) The value of work executed shall also include the valuation of Variations and Compensation Events.

- (f) All payments shall be adjusted for deductions for advance payment, security deposit, other recoveries in terms of contract and taxes at source as applicable under the law.
- (g) The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- (h) Payment of intermediate certificate shall be regarded as payments by way of advance, against the final payment and not as payments for work actually done and completed.
- (i) Intermediate payment shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or be considered as an admission of the due performance of the contractor any part thereof, in any respect or the occurring of any claim.
- (j) The payment of final bill shall be governed by the provisions of clause 36 of GCC.

## **E. Finishing the Contract**

### **35. Completion Certificate**

35.1 A Completion Certificate in the prescribed format in Contract Data shall be issued by the Engineer-in-Charge after physical completion of the Work.

35.2 After final payment to the Contractor a Final Completion Certificate in the prescribed format in the Contract Data shall be issued by the Engineer-in Charge.

### **36. Final Account**

36.1 The Contractor shall supply the Engineer with a detailed account of the total amount that the Contractor considers payable for works under the Contract within 21 days of issue of certificate of physical completion of works. The Engineer shall issue a Defects Liability Certificate and certify any payment that is due to the Contractor within 45 days of receiving the Contractor's account if it is correct and complete. If the account is not correct or complete, the Engineer shall issue within 45 days a schedule that states the scope of the corrections or additions that are necessary. If the

Account is still unsatisfactory after it has been resubmitted, the matter shall be referred to the Competent Authority as defined in the Contract Data, who shall decide on the amount payable to the Contractor after hearing the Contractor and the Engineer in Charge.

36.2 In case the account is not received within 21 days of issue of Certificate of Completion as provided in clause 32.1 above, the Engineer shall proceed to finalize the account and issue a payment certificate within 28 days.

## **F. Other Conditions of Contract**

### **37. Currencies**

All payments will be made in Indian Rupees.

### **38. Labour**

38.1 The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

38.2 The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer may require.

### **39. Compliance with Labour Regulations**

39.1 During continuance of the Contract, the Contractor and his Sub Contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the, State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that, are applicable to construction industry are given in the Contract Data. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made their under, regulations or notifications including amendments, If the Employer is caused to pay or reimburse, such amounts as may .be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/ byelaws/ Acts/Rules / regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct from any money due to the

Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer. The employees of the Contractor and the Sub Contractor in no case shall be treated as the employees of the Employer at any point of time.

**40. Audit and Technical Examination**

Government shall have the right to cause an audit and technical examination of the works and the final bill of the contract including all supporting vouchers abstract etc. to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed by him to have been done under the contract and found not to; have been executed, the Contractor shall be liable to refund the amount of overpayment and it shall be lawful for Government to recover the same from him in the manner prescribed in clause 24 above and if it is found that the Contractor was paid less than what was due to him, under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by Government to the Contractor.

**41. Death or Permanent Invalidity of Contractor**

If the Contractor is an individual or a proprietary concern, partnership concern, dies during the currency of the contract or becomes permanently incapacitated, where the surviving partners are only minors, the contract shall be closed without levying any damages/compensation as provided for in clause 28.2 of the contract agreement. However, if the competent authority is satisfied about the competence of the survivors, then the competent authority shall enter into a fresh agreement for the remaining work strictly on the same terms and conditions under which the contract was awarded.

**42. Jurisdiction**

This contract has been entered into the State of Madhya Pradesh and its validity, construction, interpretation and legal effect shall be subjected to the courts at the place where this agreement is entered into. No other jurisdiction shall be applicable.

[End of GCC]



## Contract Data

Clause reference	Particulars	Data
1.14	Employer	JABALPUR SMART CITY LIMITED
1.15	Engineer	Executive Engineer, JSCL
1.16	Engineer in Charge	Executive Engineer, JSCL
1.12	Stipulated period of completion	18 Months
3	Language & Law of Contract	English & Indian Contract Act 1872
4	Address & contact details of the Contractor	As per Annexure H
	Address & contact details of the Employer/ Engineer- phone, Fax, email.	JABALPUR SMART CITY LIMITED, Manas Bhawan, Wright Town, Jabalpur
5	Subcontracting permitted for the Contract Value	More than Rs 100 Lakhs
6	Technical Personnel to be provided the contractor—requirement, &	As per Annexure - I (Format I-3)
	Penalty, if required Technical Personnel not employed	Rs thirty thousand per month for each Graduate Engineer and Rs eighteen thousand per month for each Diploma Engineer
10	Specifications	As per Annexure E
	Drawings	As per Annexure N
12	Competent Authority for deciding dispute under Dispute Resolution System	CEO, JSCL
	Appellate Authority for deciding dispute under Dispute Resolution System	Executive Director, JSCL
13	Period for submission of updated construction program	(a) Every 3 months or (b) at the end of every milestone, whichever is less
	Amount to be withheld for not submitting construction program in prescribed period	a maximum of Rs. 50,000/- per month of delay

14	Competent Authority for granting Time Extension.	Executive Director, JSCL
15	Milestones laid down for the contract	Yes No
	If Yes, details of Milestones	As per Annexure - O
	Liquidated damage	As per Annexure - P
17	List of equipment for lab	As per Annexure - Q
	Time to establish lab	30 days from date of signing of the Agreement
	Penalty for not establishing field Laboratory	a maximum of Rs. 50,000/- per month of delay
18	Defect Liability Period	<p>5 years (Five Year)</p> <p>to execute, complete and maintain works in accordance with agreement and special conditions of contract (SCC) after issue of physical completion certificate as per "Annexure-U"</p> <p>Note: in accordance with clause 18.3 (GCC), the Engineer in Charge shall intimate the contractor about the cost assessed, for making good the defects, and if the contractor has not corrected defects, action for correction of defects shall be taken by the Engineer in Charge as below:</p> <p>(a) deploy departmental labour and material</p> <p>or</p> <p>(b) engage a contractor by issuing a work order at contract rate/SOR rate</p> <p>or</p> <p>(c) sanction supplementary</p>

		<p>work in an existing agreement to a contractor for zonal works or similar other work</p> <p>or</p> <p>(d) invite open tender</p> <p>or</p> <p>(e) combination of above</p>
19	Competent Authority for determining the rate	As per book of financial power (updated)
20	Any other condition for breach of contract	<p>Yes, as below:</p> <p>If the contractor fails to achieve 50% financial progress in any milestone and /or fails to achieve 75% financial progress in two consecutive mile stones</p>

Clause reference	Particulars	Data
28	Penalty	Penalty Shall include (a) Security deposit as per clause 30 of General Conditions of Contract and (b) Liquidated Damages imposed as per clause 15 or Performance Security (Guarantee) including Additional Performance Security (Guarantee), if any, as per clause 29 of General Conditions of Contract, whichever is higher
29	Performance guarantee (Security) shall be valid up to	<b>Three months beyond the completion of Defect Liability Period (Maintenance Guarantee Period) and Additional Performance guarantee valid up to stipulated time of completion plus three months</b>
30	Security Deposit to be deducted from each running bill	At the rate of <b>5%</b> of Gross Amount of Running Bill
	Maximum limit of deduction of Security Deposit	Up to 5% of Final Contract Amount.
31	Price Adjustment formula and procedure to calculate	As per Annexure R and as below: (a) The price Adjustment shall apply only in respect of <b>Cement, Steel, Bitumen</b> and <b>POL</b> components.
32	32:1 Mobilization and Construction Machinery Advance Applicable	No Mobilization and Construction Machinery Advance payable .
	32.2 If yes, Unconditional Bank Guarantee	Not Applicable
	32.3 If yes, Rate of interest chargeable on advances	Not Applicable
	32.4 If yes, Type & Amount of Advance payment that can be paid	Not Applicable
	32.5 If yes, Recovery of advance payment	Not Applicable

Clause reference	Particulars	Data
33	33.1 secured Advance Applicable	Not Applicable
	33.2 if yes, Unconditional Bank Guarantee	Not Applicable
	33.2 if yes, Amount of Secured Advance :	Not Applicable
	33.3 if yes, Conditions for secured advance .	Not Applicable
	33.4 if yes, Recovery of Secured advance	Not Applicable
35	Completion certificate - after physical completion of the Work	As per Annexure - U
	Final Completion Certificate — after final payment on completion of the Work	As per Annexure-V
36	Competent Authority	CEO, JSCL
39	Salient features of some of the major labour laws that are applicable	As per Annexure - W
41	Competent Authority	Executive Engineer, JSCL

## **Drawings**

List of drawings

1. SITE PLAN
2. FLOOR PLAN LVL -1200
3. FLOOR PLAN LVL +1300
4. ELEVATIONS 1
5. ELEVATIONS 2
6. SECTIONS
7. STRUCTURE: FOUNDATION PLAN
8. PLINTH BEAM PLAN
9. ROOF FRAMING PLAN
10. ELECTRIC LAYOUT PLAN LVL -1200
11. ELECTRIC LAYOUT PLAN LVL +1300
12. SITE PLUMBING LAYOUT
13. GREEN ROOF DETAIL

**Details of Milestones**

Mile Stone 1:-

1/8th of the whole work before 1/4th of the whole time allowed has elapsed,

Mile Stone 2:-

3/8th of the whole work before 1/2th of the whole time allowed has elapsed

Mile Stone 3:-

3/4th of the whole work before 3/4th of the whole time allowed has elapsed

Mile Stone 4:-

complete work within the stipulated time

### **Compensation for Delay**

If the contractor fails to achieve the milestones, and the delay in execution of work is attributable to the contractor, the Employer shall retain an amount from the sums payable and due to the contractor as per following scale -

- i. Slippage up to 25% in financial target during the milestone under consideration 2.5% of the work remained unexecuted in the related time span.
- ii. Slippage exceeding 25% but Up to 50% in financial target during the milestone under consideration - 5% of the work remained unexecuted in the related time span.
- iii. Slippage exceeding 50% but Up to 75% in financial target during the milestone under consideration -7.5% of the work remained unexecuted in the related time span,
- iv. Slippage exceeding 75% in financial target during the milestone under consideration-10% of the work remained unexecuted in the related time span.

**Note:** For arriving at the dates of completion of time span related to different milestones, delays which are not attributable to the Contractor shall be considered. The slippage on any milestone is if made good in subsequent milestones or at the time of stipulated period of completion, the amount retained as above shall be refunded. In case the work is not completed within the stipulated period of completion along with all such extensions which are granted to the Contractor for either Employer's default or Force Majeure, the compensation shall be levied on the contractor at the rate of 0.05% per day of delay limited to a maximum of 10% of contract price. The decision of Superintending Engineer shall be final and binding upon both the parties.



**List of Equipment for Quality Control Lab**

As per Annexure I-4

### PRICE ADJUSTMENT

The formulas for adjustment of price are as follow:

R = Value of work as defined in Clause 31.2(3) of General Conditions of Contract

#### Weightages\* of component in the work

S.No.	Component	Percentage of Component in the work
1.	Cement -P <sub>c</sub>	18%
2.	Steel -P <sub>s</sub>	13%
3.	Bitumen -P <sub>b</sub>	0%
4.	POL P <sub>f</sub>	5%

\* Weightages of various components of the work shall be as determined by the competent Technical authority.

#### Adjustment for cement component

(ii) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula:

$$V_c = 0.85 \times P_c / 100 \times R \times (C_1 - C_0) / C_0$$

V<sub>c</sub>= increase or decrease in the cost of work during the month under Consideration due to changes in rates for cement.

C<sub>0</sub>= The all India wholesale price index for Grey cement on the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi ([www.eaindustry.nic.in](http://www.eaindustry.nic.in))

C<sub>1</sub>= The all India average wholesale price Index for grey cement for the month under consideration as published by Ministry Government of India, New Delhi. ([www.eaindustry.nic.in](http://www.eaindustry.nic.in))

P<sub>c</sub>= Percentage of cement component of the work

**Note:** For the application of this clause, index of Grey Cement has been chosen to represent Cement group.

#### **Adjustment of steel component**

(iii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$$V_s = 0.85 \times P_s \times /100 \times R \times (S_1 - S_0) / S_0$$

$V_s$  = Increase or decrease in the cost of work during the month under consideration due to changes in the rates for steel.

$S_0$  = The all India wholesale price index for steel (Bars and Rods) on the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi ([www.eaindustry.nic.in](http://www.eaindustry.nic.in))

$S_1$  = The all India average wholesale price index for steel (Bars and Rods) for the month under consideration as published by Ministry of Industrial Development, New Delhi ([www.eaindustry.nic.in](http://www.eaindustry.nic.in))

$P_s$  = Percentage of steel component of the Work.

**Note:** For the application of this clause, index of Bars and Rods has been chosen to represent steel group.

#### **Adjustment bitumen component**

(iv) Price adjustment for increase or decrease in the cost of bitumen shall be paid in accordance with the following formula:

$$V_b = 0.85 \times P_b / 100 \times R \times (B_1 - B_0) / B_0$$

$V_b$  = Increase or decrease in the cost of work during the month under consideration due to changes in rates for bitumen.

$B_0$  = The official retail price of bitumen at the IOC depot at nearest center on the date of opening of Bids.

$B_1$  = The official retail price of bitumen of IOC depot at nearest center for the 15<sup>th</sup> day of the month under consideration.

$P_b$  = Percentage of bitumen component of the work.

#### **Adjustment of POL (fuel and lubricant) component**

(V) Price adjustment for increase or decrease in cost of POL (fuel and lubricant) shall be paid in accordance with the following formula:

$$V_f = 0.85 \times P_f / 100 \times R_x (F_i - F_o) / F_o$$

$V_f$ = Increase or decrease in the cost of work during the month under consideration due to changes in rates for fuel and lubricant.

$F_o$ = The official retail price of High speed Diesel (HSD) at the existing consumer pumps of IOC at nearest center on the date of opening of Bids.

$f_i$  = The official retail price of HSD at the existing consumer pumps of IOC at nearest center for the 15th day of month of the under consideration.

$P_f$ = Percentage of fuel and lubricants component of the work.

Note: For the application of this douse, the price of High Speed Diesel has been chosen to represent fuel and lubricants group.

(See clause 32 of Section 3-GCC)

**Bank Guarantee Form for Mobilization and Construction Machinery Advance**

To

\_\_\_\_\_ [name of Employer]

\_\_\_\_\_ [address of Employer]

\_\_\_\_\_ [name of Contractor]

In accordance with the provisions of the General Conditions of Contract, clause 31 ("Mobilization and Construction Machinery Advance") of the above-mentioned Contract \_\_\_\_\_ [name and address of Contractor] (hereinafter called "the Contractor") shall deposit with \_\_\_\_\_ [name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of \_\_\_\_\_ [amount of Guarantee]\* \_\_\_\_\_ [in words].

We, the \_\_\_\_\_ (bank of financial institution), as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as surety merely, the payment to \_\_\_\_\_ (name of Employer) on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding '[amount of guarantee]\* \_\_\_\_\_ [in words].

We further agree that no change or addition to or other modification of the terms of the Contractor or Works to be performed thereunder or of any of the Contract documents which may be made between \_\_\_\_\_ [name of Employer] and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the contract until \_\_\_\_\_ [name of Employer] receives full repayment of the same amount from the Contractor.

Yours truly,

Signature and Seal: \_\_\_\_\_

Name of Bank/Financial Institution: \_\_\_\_\_

Address: \_\_\_\_\_

Date: \_\_\_\_\_

\* An amount shall be inserted by the Bank or Financial Institution representing the amount of the Advance Payment and denominated in Indian Rupees.

**Bank Guarantee Form for Secured Advance**

**INDENTURE FOR SECURED ADVANCES**

This indenture made the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_ BETWEEN \_\_\_\_\_ (hereinafter called the contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) or the one part and the Employer of the other part.

Whereas by an agreement dated \_\_\_\_\_ (hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Employer that he may be allowed advanced on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to executive at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges)

AND WHEREAS the Employer has agreed to advance to the Contractor the sum of Rupees \_\_\_\_\_ on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advance attached to the Running Account Bill for the said works signed by the Contractor on \_\_\_\_\_ and the Employer has reserved to himself the option of making any further advance or advances on the authority of other materials brought by the Contractor to the site of the said works.

Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees \_\_\_\_\_ on or before the execution of these presents paid to the Contractor by the Employer (the receipt where of the Contractor doth hereby 'acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the President and declare as follows:

That the said sum of Rupees \_\_\_\_\_ so advanced by the Employer to

- (1) the Contractor as aforesaid and all or any further sum of sums advanced as aforesaid shall be employed by the Contractor in or towards expending the execution of the said works and for no other purpose whatsoever.
- (2) That the materials details in the said Account of Secured Advances which have been offered to and accepted by the Employer as security are absolutely the Contractor's own propriety and free from encumbrances of any kind and the contractor will not make

any application for or receive a further advance, on the security Of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnified the Employer against all claims to any materials in respect of which an advance has be made to him as aforesaid.

- (3) That the materials detailed in the said account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Engineer.
- (4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same required by the Engineer.
- (5) That the said materials shall not be removed from the site of the said works except with the written permission of the Engineer or an officer authorized by him on that behalf.
- (6) That the advances shall be repayable in full when or before the Contract receives payment from the Employer of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Employer-will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.
- (7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing of the Employer shall immediately on the happening of such default were payable by the

Contractor to be the Employer together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the Employer in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the Employer to repay and pay the same respectively to him accordingly.

- (8) That the Contractor hereby charges all the said materials with the repayment to the Employer of the said sum of Rupees \_\_\_\_\_ and any further sum of sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the power contained therein if and whenever the covenant for payment and repayment here-in-before contained shall become enforceable and the money owing shall not be paid in accordance there with the Employer may at any time thereafter adopt all or any of the following courses as he may deem best:
- (a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provision in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due to the contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the contractor, he is to pay same to the Employer on demand.
  - (b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or repayable to the Employer under these presents and pay over the surplus (if any) to the Contractor.
  - (C) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.
- (9) That except in the event of such default on the part of the contractor as aforesaid interest on the said advance shall not be payable.
- (10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been here-in-before expressly provided for the same shall be referred to



the Employer whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

(See clause 35 of Section 3 -GCC)

**Physical Completion Certificate**

Name of Work:

.....  
.....  
.....

Agreement No .....Date .....

Amount of Contract Rs .....

Name of Agency .....

Used MB No. ....

Last measurement recorded

a. Page No. & MB No. \_\_\_\_\_

b. Date \_\_\_\_\_

Certified that the above mentioned work was physically completed on .....(date) and taken over on .....(date) and that I have satisfied myself to best of my ability that the work has been done properly.

Date of issue

Executive Engineer

.....  
.....

(See clause 35 of Section 3-GCC)

**Final Completion Certificate**

Name of Work:

.....  
.....  
.....

Agreement no ..... Date .....

Name of Agency: .....

Used MB No. ....

Last measurement recorded

a: Page No. & MB No. \_\_\_\_\_

b. Date \_\_\_\_\_

Certified that the above mentioned work was physically completed on  
.....(date) and taken over on .....(date).

Agreed amount Rs .....

Final Amount paid to contractor Rs. ....

Incumbency of officers for the work

I have satisfied myself to best of my ability that the work has been done properly.

Date of issue

Executive Engineer

.....  
.....

### **Salient Features of Some Major Labour Laws Applicable**

- a) **Workmen Compensation Act 1923** The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- b) **Payment of Gratuity Act 1972:-** Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed the prescribed minimum years (say, five years) of service or more or on death the rate of prescribed minimum days' (say, 15 days) wages for every completed year of service. The Act is applicable to all establishments employing the prescribed minimum number (say, 10) or more employees.
- c) **Employees P.F. and Miscellaneous Provision Act 1952:** The Act Provides for monthly contributions by the Employer plus workers at the rate prescribed (say, 10% or 8.33%), The benefits payable under the Act are:
  - i. Pension or family pension on retirement or death as the case may be.
  - ii. Deposit linked insurance on the death in harness of the worker.
  - iii. Payment of P.F. accumulation on retirement/death etc.
- d) **Maternity Benefit Act 1951:** - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- e) **Contract Labour (Regulation & Abolition) Act 1970:** - The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The principal Employer is required to take certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ prescribed minimum (say 20) or more contract labour.
- f) **'Minimum Wages Act 1948;** - The Employer is to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of buildings, roads, runways is scheduled employment.
- g) **Payment of Wages Act 1936:** - It lays down as to by what date the wages are to be paid when it will be paid and what deductions can be made from the wages of the workers.

- h) **Equal Remuneration Act 1979:** - The Act provides for payment of equal wages for work of equal nature to male and female workers and for not making discrimination against female employees in the matters of transfers, training and promotions etc.
- l) **Payment of Bonus Act 1965:** - The Act is applicable to all establishments employing prescribed minimum (say, 20) or more workmen. The Act provides for payments of annual bonus within the prescribed range of percentage of wages to employees drawing up to the prescribed amount of wages, calculated in the prescribed manner. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. States may have different number of employment size.
- j) **Industrial Disputes Act 1947:** - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- k) **Industrial Employment (Standing Orders) Act 1946:** - It is applicable to all establishments employing prescribed minimum (say, 100, or 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and gets these certified by the designated Authority.
- l) **Trade Unions Act 1926:** - The Act lays down the procedure for registration of trade unions of workmen and Employers. The Trade Unions registered under the Act have, 'been given certain immunities from civil and criminal liabilities.
- m) **Child Labour (Prohibition & Regulation) Act 1986:** - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulations of employment of children in all other occupations and processes. Employment of child labour is prohibited in building and construction industry.
- n) **Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act 1979:** - The Act is applicable to an establishment which employs prescribed minimum (say, five) or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as Housing, Medical-Aid, Traveling expenses from home up to the establishment and back etc.
- o) **The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996** - All the establishments who carry on any building or other construction work and employs the prescribed minimum (say, 10) or more workers are covered under this Act. All such establishments are required to pay

cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

- p) **Factories Act 1948:** - The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing the prescribed minimum (say, 10) persons or more with aid of power, or another prescribed minimum (say, 20) or more persons without the aid of power engaged in manufacturing process.

## **SECTION 3**

### **Conditions of Contract**

**Part — II Special Conditions of Contract [SCC]**

## BILL OF QUANTITIES

**Name of Work:** Construction of Underground Intimate Theater with Interior work, Allied Services work and Landscaping at Bhawartal Park, Jabalpur (M.P.).

**Probable Amount of Contract:** RS. 14.11 Crore  
In Words, Rupees Fourteen Crore Eleven Lacs Only

FORMAT - B							
<b>DETAILED ESTIMATE FOR INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR</b>							
<b>PROMOTER: JABALPUR SMART CITY LIMITED</b>							
All Amount in Rs.							
S.No	Name Of Project Sub Head	Built Up Area in Sq.m.	Amount SOR	Amount NON SOR	Amount TOTAL	Unit Area Rate (Rs./Sq. m.)	Reference Format
1	2	3	4	5	6	7	8
1	Cost of construction of Intimate theatre	2019.65	102,178,677	9,657,269	111,835,946	55,374	Format C
2	Amenities - Intimate theatre	2019.65	-	23,310,649	23,310,649	11,542	Format C
<b>SUB TOTAL</b>		<b>2019.65</b>	<b>102,178,677</b>	<b>32,967,918</b>	<b>135,146,595</b>	<b>66,916</b>	<b>Format C</b>
D	SITE DEVELOPMENT	2019.65	5,185,078	766,147	5,951,225	2,567	Format D
<b>TOTAL</b>			<b>107,363,755</b>	<b>33,734,065</b>	<b>141,097,820</b>	<b>69,483</b>	
<b>PROJECT TOTAL</b>					<b>141,097,820</b>	<b>14.11 CRORE</b>	



**INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR**

							FORMAT - C
<b>DETAILED ESTIMATE FOR INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR</b>							
<b>Name of Project Sub Head :-</b>			Cost of construction of AUDITORIUM BUILDING				
<b>Built up Area ( in Sqm. ) :-</b>			2,020		SQM		
<b>GENERAL ABSTRACT</b>							
							All Amount in Rs.
Type Of Work	Component NO.	Name of Component	Amount SOR	Amount NON SOR	Amount TOTAL	Unit Area Rate (Rs./Sq.m. )	Reference Format
1	2	3	4	5	6	7	8
BUILDING WORKS	1	Civil Work	72,185,801	-	72,185,801	35,742	Format 1A
	2	Interior Work	21,975,190	9,657,269	31,632,459	15,662	Format 1B
	3	Internal Water supply ,Plumbing and Sanitary	978,654	-	978,654	485	Format 1 C
	4	Internal Electrification	7,172,075	-	7,172,075	3,551	Format 1D
	<b>Sub Total - BUILDING WORKS</b>			<b>102,311,719</b>	<b>9,657,269</b>	<b>111,968,988</b>	<b>55,440</b>
BUILDING AMENITIES	5	Fire suppression system		1,732,274	1,732,274	858	Format 1E
	6	fire Alarm System		604,326	604,326	299	Format 1F
	7	HVAC		5,577,939	5,577,939	2,762	Format N
	8	Lifts		3,777,000	3,777,000	1,870	Format L
	9	Sound System		4,652,452	4,652,452	2,304	Format M
	10	Furniture		6,470,027	6,470,027	3,204	Format P
	11	CCTV		496,631	496,631	246	Format Q
	<b>Sub Total - AMENITIES</b>			<b>-</b>	<b>23,310,649</b>	<b>23,310,649</b>	<b>11,542</b>
<b>(BUILDING WORKS + AMENITIES)</b>			<b>102,311,719</b>	<b>32,967,918</b>	<b>135,279,637</b>	<b>66,982</b>	

**INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR**

						FORMAT - D	
<b>DETAILED ESTIMATE FOR INTIMATE THEATRE AT BHAWARTAL PARK, JABALPUR</b>							
<b>Name of Project Sub Head :-</b>		SITE DEVELOPMENT					
<b>Building Area in Sq.m. :-</b>		2,019.65 sqm					
<b>General Abstract- Site Development</b>							
						All Amount in Rs.	
Type Of Work	Component NO.	Name of Component	Amount SOR	Amount NON SOR	Amount TOTAL	Unit Area Rate (Rs/Sqm.)	Reference Format
1	2	3	4	5	6		8
SITE DEVELOPMENT	1	External Water Supply	513,390.00	-	513,390.00	254	Format T
	2	External electrification	3,219,506	-	3,219,506	1,594	Format U
	3	External Drainage	601,238.50	-	601,238.50	298	Format V
	4	Landscaping	850,943.50	766,147.43	1,617,091	801	Format W
		<b>Total SITE SERVICES</b>	<b>5,185,078</b>	<b>766,147</b>	<b>5,951,225</b>	<b>2,947</b>	

**SECTION 5**  
AGREEMENT FORM

AGREEMENT

This agreement, made on the \_\_\_\_\_ day of \_\_\_\_\_ between: \_\_\_\_\_ (name and address of Employer) (hereinafter called "the Employer) and \_\_\_\_\_ (name and address of contractor) hereinafter called "the Contractor" of the other part.

Whereas the Employer is desirous that the Contractor execute \_\_\_\_\_(name and identification number of Contract) (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at a cost of Rs.....

**NOW THIS AGREEMENT WITNESSED as follows:**

1. In this Agreement, words and expression shall have the same meaning as are respectively assigned to them in the conditions of contract hereinafter referred to and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein Contract Price or such other Sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be ready and construed as part of this Agreement viz.
  - i. Letter of Acceptance
  - ii. Contractor's Bid
  - iii. Condition of Contract: General and Special -
  - iv. Contract Data
  - v. - Bid Data
  - vi. Drawings
  - vii. Bill of Quantities and
  - viii. Any other documents listed in the Contract Data as forming part of the Contract.

In witnessed whereof the parties there to have caused this Agreement to be executed the day and year first before written.

The Common Seal of \_\_\_\_\_ was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said \_\_\_\_\_ in the presence of:

Binding Signature of Employer \_\_\_\_\_

Binding Signature of Contractor \_\_\_\_\_