

Tender No.: BHU/P&E/10/2024-25/28 DATED 04.10.2024



STATE BANK OF INDIA

LOCAL HEAD OFFICE,
III/1, Pt. J. N. MARG
BHUBANESWAR

TENDER NO. BHU/P&E/10/2024-25/28

DATE: 04.10.2024

Part – I (Technical Bid)

NOTICE INVITING e-TENDER

TENDER DOCUMENT FOR COMPOSITE CONTRACTORS FOR INTERNAL RE-FURBISHING (2ND TO 5TH FLOOR) AND ALLIED CIVIL WORKS INCLUDING EXTERNAL FAÇADE WORKS, INTERNAL ELECTRICAL & EXTERNAL WORKS (LT), FIXED FIRE FIGHTING SYSTEM, AUTOMATIC FIRE DETECTION & ALARM SYSTEM, PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM (BASEMENT-2 TO 6TH FLOOR), TELECOM & DATA CABLING WORKS AT EXISTING LHO BUILDING AT BHUBANESWAR, ODISHA.

Name of the Tenderer : _____

Address : _____

Date & Time of Opening of Tender: 18.10.2024 at 4:00 pm.

M/s Architect Narayan & Associates Pvt. Ltd.

(ANAPL)

304 3rd Floor, Antariksh building, Makhawana Road,

Marol Andheri East, Mumbai-400059

9321211705/9892216644

Eligibility Criteria: ENLISTED COMPOSITE contractors found eligible vide our previous tender no. **BHU/P&E/08/2024-25/16 dated 23.08.2024.** Vendor/Contractor should possess valid digital signature for this e-tender.

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha

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Notice Inviting Tender (e-NIT)

WORK: External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha.

Tender reference No: **BHU/P&E/10/2024-25/28**

SBI, LHO invites two bid percentage rate based e- Tenders from eligible enlisted COMPOSITE contractors vide our previous tender no. **BHU/P&E/08/2024-25/16 dated 23.08.2024** for ‘Pre-Qualification of composite Contractors for composite contractors for internal refurbishing (2nd to 5th floor) and allied civil works including external façade works, internal electrical & external works (LT), fixed firefighting system, automatic fire detection & alarm system, public address and voice evacuation system (basement-2 to 6th floor), telecom & data cabling works at existing LHO building at Bhubaneswar, Odisha”. The other details of the tender are as under

| | | |
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| 1. | Name of Work | External & Internal renovation of LHO building (2 nd to 5 th floor), Bhubaneswar, Odisha. |
| 2 | Eligibility criteria | Contractors found eligible vide our previous Pre-qualification tender no. <u>BHU/P&E/08/2024-25/16 dated 23.08.2024</u> |
| 3 | Estimated cost put to tender | Rs 19,29,29,790.00 (Nineteen Crores Twenty Nine Lakhs Twenty Nine Thousand & Seven Hundred Ninety Only) plus GST. |
| 4 | Time of Completion | 8 (Eight) Calendar Months from the date of handover of site to the Contractor. |
| 5 | Earnest Money Deposit (EMD) | Rs.19,29,000.00 (Rupees Nineteen Lakhs Twenty Nine Thousand Only) in the form of Demand Draft/Banker’s Cheque issued by any Nationalised /Scheduled Bank Drawn in favour of “ State Bank of India. ” Payable at Bhubaneswar ”. The EMD shall be submitted to SBI, LHO, III/1, Pt. J. N. Marg, Bhubaneswar, in a separate envelope super scribing “EMD. <u>Vendors having NSIC/ MSME certificates are not required to submit the EMD. Scan copy of Registration Certificate shall be submitted. However, no exemption shall be entertained towards Initial security deposit (ISD) as per T&C of the contract.</u> |
| 6 | Security Deposit | 5% of the final bill value. |
| 7 | Availability of Tender document. | Contractor should download Tender documents from e-tendering portal from 04.10.2024 up to 3:00 PM on 18.10.2024 from e-Tender portal <u>https://etender.sbi</u> or Bank’s website |

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha

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| | | <p>www.sbi.co.in<link>SBI in the News>Show More>Procurement. But the bidder need to submit digitally signed copy on-line only in the e-tendering portal only.</p> |
| 8 | Pre-bid Meeting | <p>Online pre-bid meeting At 11:00 AM on 08.10.2024. <u>Click Here</u> to join the meeting, through MS Teams application.</p> |
| 9 | Last date, time, and place for submission of Online Technical Bid. | <p>The eligible agencies/ companies are required to submit the scan copies of following documents on-line on service provider portal i.e https://etender.sbi, on or before</p> <p>Dt. 18.10.2024 up to 03:00 PM.:</p> <ul style="list-style-type: none"> i) Payment receipt of the Tender processing fee, if any. ii) Earnest Money Deposit (EMD). iii) Process Compliance form (Annexure-I) in company letterhead duly signed and stamped by authorized representative. iv) Letter of Undertaking in company letterhead duly signed and stamped by authorized representative. <p><u>The scan copy of the EMD and technical bid digitally signed are to be submitted online on or before 18.10.2024 up to 03:00 PM. However, the aforesaid documents (original) need to be submitted physically at the aforesaid address on or before due date.</u></p> <p><u>The SBI shall not entertain EMD received late due to any delay on account of delivery by the courier agency/speed post or any other mode for the reasons whatsoever. Tenders received without any one or more documents mentioned above shall be rejected.</u></p> <p>The technical bid and price bid shall be submitted online only. Price bid of technically qualified vendors will be opened online.</p> |
| 10 | Last date, time and Mode of submission of | <p>The Price Bids is to be submitted by enlisted vendors online on the service provider portal i.e https://etender.sbi on or before the 3:00 PM of 18.10.2024 as notified in the e-tendering portal. En-</p> |

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| | <u>Online Price Bid</u> | <p>listed vendors shall also be informed by mail for participating in the e-tendering process.</p> <p>The bidder (Company/Authorized person) should have a valid digital signature for this e-tender. E-tendering guidelines may be obtained from:</p> <p>Service provider: Sujith Nair Dy. Manager – Client Service e-Procurement Technologies Limited Address: B-704, Wall Street – II, Opp. Orient Club, Ellisbridge, Ahmedabad – 380006, Gujarat, India Contact: sujith@eptl.in Phone: 9904407199 Mubassera@eptl.in Phone: 7859800621 Office Hours: (Monday – Friday: 10:00 AM – 7:00 PM (IST), Saturday: 10:00 AM – 6:00 PM (IST)) (Exclusion: Sunday, Holidays and 2nd & 4th Saturday)</p> |
| 11 | Date, Time, and Place of opening of online Technical Bid. | Technical bid (Part-I): After 4.00 PM on 18.10.2024 at the Office of AGM (P&E), 2 nd Floor, LHO building, Kharvelnagar, Bhubaneswar. <u>Click Here</u> to participate in the bid opening process, through MS Teams application. |
| 12 | Date, Time, and Place of the opening of Online Price Bid. | Price bid (Part-II): After 4.30 PM on 18.10.2024 , at the Office of AGM(P&E), 2 nd Floor, LHO building, Kharvelnagar, Bhubaneswar |
| 13 | Defect Liability Period | 1 year from the date of issue of virtual completion certificate |
| 14 | Validity of Offer | 90 days from the date of opening of the Price-Bid |
| 15 | Commencement of work. | As advised in the Work Order. |
| 16 | Liquidated Damages (LD) | LD shall be imposed at the rate 0.5 % Per week for delay subject to maximum amount of 5% of the accepted Contract/ final work Value. |
| 17 | Terms and Mode of payment | <p>i) No mobilization payment will be entertained. However, advance against material at site may be entertained, subject to satisfaction of Bank.</p> <p>ii) The interim/running payment of Rs. 100.00 Lakhs will be entertained subject to execution of works.</p> <p>iii) After successful completion of entire work balance or 100% payment will be released against submission</p> |

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| | | of tax invoice and work completion certificates. iv) Payment shall be made by way of Electronic fund transfer and the bill will be paid by the SBI. Firm should furnish details of the bank, A/c no, IFSC code. v) Any Tax invoice raised to the Bank, should bear the GST Number 21AAACS8577K1Z1 of State Bank of India for Bhubaneswar LHO. |
| 18 | Contact Person for sending any kind of correspondence regarding this tender | For any Technical queries: Architect's side: Project Architect: 9321211705/9892216644 Email: tasleem@architectnarayan.com / rln@architectnarayan.com Bank's side Sri Sujoy Roy, AGM (Civil)-9674710327, Sri Kuldeep Srivastav, Fire Officer-7600035062, Sri Prakash Chandra Sethi, Manager (Civil)-9491041610, Sri Tapan Kumar Behera, Manager (Elect)-9867991919 P & E Dept., SBI, LHO, Bhubaneswar, Email: agmpre.lhobhu@sbi.co.in |

- In case the date of opening of tenders is declared as a holiday, the tenders will be opened on the next working day at the same time. The bidder, who is the authorized representative and participating on behalf of the company/ Dealer/vendor, should have a valid digital signature certificate (DSC) for this e-tender or in firm's name.
- SBI reserves the right to increase or decrease the quantum of services, and manpower to be provided and also reserves the right to reject, cancel or revise or accept any or all the tenders or part of tenders without giving any reasons thereto.
- SBI reserves its rights to accept/reject any/all tender without assigning any reasons whatsoever and to increase or decrease the quantities of any item and the contractor has to execute the same at the rate quoted and no correspondence shall be entertained in this regard. The successful bidder shall sign and stamp each page of the tender document thereby ensuring the number and sequence of all pages after the completion of the tendering procedures. Conditional tenders are liable for rejection.

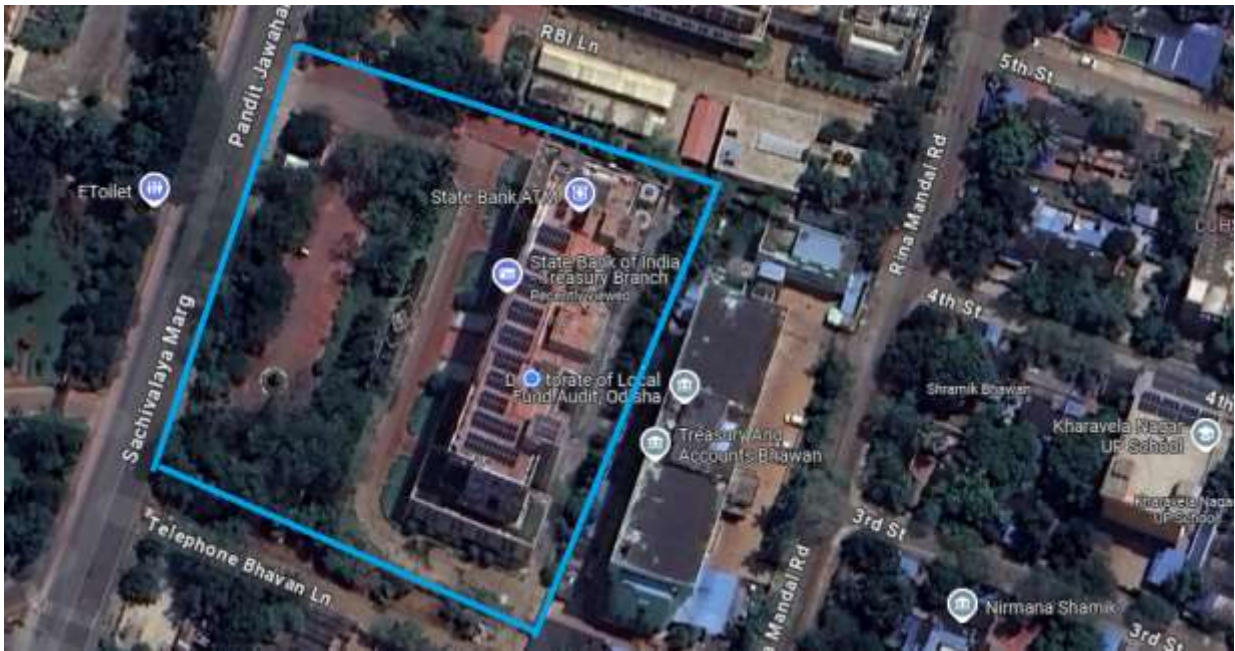
(ANAPL)
(For and behalf of Assistant General Manager)
SBI, LHO, Bhubaneswar

INSTRUCTIONS TO THE TENDERERS

1.0 Scope of Work

Sealed online Tenders are invited by M/s. Architect Narayan & Associates Pvt. Ltd. project architect for and behalf of State Bank of India for the work of “**External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha**”..

1.1 Site and Its Location: Local Head Office, State Bank of India, Pt. J. N Marg, Bhubaneswar-751001, Odisha. The building consists of 2 basements and ground floor plus 6 floors i.e (B1+B2+G+6) storied building, having approximate built up area of 1,60,873 Sqft (Each floor appx 15,000 sqft). The adjacent buildings to this existing SBI LHO building at Bhubaneswar are RBI office building in the right and BSNL Office building in the left side.



1.2 Brief description of work:

The project involves external renovation of the building such as road widening, shifting of existing gate position, facelift of facade and allied civil works.

- a) Interior furnishing of 2nd to 5th floor of LHO building
- b) Fixing of tiles / Carpets in the floors as directed by Bank
- c) Fixing of modular furniture and false ceiling
- d) Renovation of washrooms at all floors except 6th floor.
- e) Renovation of all ducts
- f) Replacement of main LT electrical panel & APFC panel at Substation
- g) Removal existing of GI duct of HVAC system (centralized Chiller Plant) (2nd to 5th floor)
- h) Provision of rising main in the building
- i) Provision of ventilation at Washrooms
- j) Internal electrical arrangements in connection to furniture works (2nd to 5th floor)

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- k) Demolition works comprises such removal of existing furniture, false ceiling, electrical wire/cables, points, switches, lights, fittings & fixture, UPS, Split Air-conditioner, Electrical panels, distributions board etc.
- l) Dismantling of existing washroom comprising works such as removal of tiles, pipelines, doors, windows, sanitary fitting & fixtures etc.
- m) Revamp of Fixed Fire Fighting System (Dismantling of existing system & SITC of new system)
- n) Revamp of Automatic Fire Detection & Alarm System, Public Address and Voice Evacuation System
- o) Removal of all items as described in the BOQ/SOQ shall be paid by the Bank. However, for buying the same from the Bank, the salvage value as mentioned as mentioned under the item head of BUY BACK of Schedule of Quantities in the tender shall be recovered from the Contractor's running/interim bill. The rate as derived for total salvage value is inclusive of all transportation, freight, loading, unloading charges etc, where no further extra charges shall be admissible in this regard.
- p) The Contractor should note, as the Office proposed for renovation is a running premises, therefore, all the buyback items/ materials/ equipments needs to be removed/shifted/deployed manually by the labour and at any case shifting of any item/material/equipment through the lift is prohibited for the Contractor.
- q) The Contractor has to ensure as works has be executed in the running premises, as Office will be functioning in other floors of this building, therefore, work has to be executed by the Contractor without causing any in-convenience to the Staffs as well as functioning of the Office.

1.2.1 Co-ordination among Vendors:

The existing HAVC (Centralized HVAC Chiller Plant having capacity 2 X 250 TR) of LHO building is supplied and maintained by OEM. In this connection, Bank intend to appoint a HVAC vendor to take up work associated with HVAC such as replacement of cooling tower base, replacement of AHU, condenser line & corroded chilled line, fresh air ventilation system, pressurization, along with AC duct work of each floor etc. Accordingly, the composite vendor has to execute the work keeping co-ordination with associated HVAC vendor & existing HVAC maintenance OEM. It is also responsibility of composite contractor to maintain co-ordination with/among all contractors/Vendors at each & every step of this project, as time is the essence of this project. Hence, it is the responsibility of the contractor to obtain all necessary clearance / approval of drawing(s) / permission from the project Architect/ Bank.

2.0 Tender Documents

2.1 The work has to be carried out strictly according to the conditions stipulated in tender consisting the following documents and the most workman like manner,

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1. Instructions to tenderers
2. General Conditions of Contract
3. Special Conditions of Contract
4. Additional Conditions for Electrical Installation
5. Additional conditions for firefighting Systems
6. Technical Specifications
7. Drawings
8. Priced Bid

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

1. Price Bid
2. Technical Specifications
3. Additional Conditions for Electrical Installation
4. Special Conditions of Contract
5. General Conditions of Contract
6. Instructions to Tenderers

2.3 Complete set of tender documents including relative drawings can be downloaded from the Bank's website for the drawings, if required may be obtained in person from the Architects Office at 304, 3rd Floor, Antariksh building, Makhawana Road, Marol, Andheri (E), Mumbai-400059 between 10.00 to 15.00 Hrs on any day except holidays during the period as mentioned in the NIT.

2.4 The tender documents are not transferable.

3.0 **Site Visit**

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

4.0 **Earnest Money**

The tenderers are requested to submit the Earnest Money of aforesaid amount in the form of Demand

- 4.1 Draft or Banker's Cheque in favour of State Bank of India drawn on any Bank India.
- 4.2 EMD in any other form other than as specified above will not be accepted. Tender not accompanied by the EMD in accordance with clause 4.1 above shall be rejected.

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- 4.3 No interest will be paid on the EMD.
- 4.4 EMD of unsuccessful tenderers will be refunded within 30 days of award of Contract.
- 4.5 EMD of successful tenderer will be retained as a part of security deposit.

5.0 Initial Security Deposit

The successful tenderer will have to submit a sum equivalent to 2% of contract value less EMD by means of D/D drawn in favour of State Bank of India within a period of 15 days of acceptance of tender.

6.0 Security Deposit

- 6.1 Total security deposit shall be 5% of contract value. Out of this 2% of contract value is in the form of initial security deposit which includes the EMD. Balance 3% shall be deducted from the running account bill of the work at the rate of 10% of the respective running account bill i.e. deduction from each running bill account will be 10% till total 3% of contract value is reached. 50% of the total security shall be paid to the contractors on the basis of architect's certifying the virtual completion. The balance 50% would be paid to the contractors after the defects liability period as specified in the contract.
- 6.2 No interest shall be paid to the amount retained by the Bank as Security Deposit.
- 6.3 Additional Security Deposit:- Additional Security deposit (ASD)/Additional performance Guarantee (APG) shall be applicable if the bid price is below 7.5 % of the estimated cost put to tender. The amount of such ASD/ APG shall be the difference between 92.5 % of estimated cost put to tender and the quoted price.

7.0 Signing of Contract Documents

The successful tenderer shall be bound to implement the contract by signing an agreement and conditions of contract attached herewith within 15 days from the receipt of intimation of acceptance of his tender by the Bank. However, the written acceptance of the tender by the Bank will constitute a binding agreement between the Bank and successful tenderer whether such formal agreement is subsequently entered into or not.

- 8.0 **Completion Period:** The time period allowed for completion of the project shall be **Eight (8) months** from the date of commencement of work or 15 days from the date of issuance of work order, whichever is earlier.

9.0 Validity of Tender

Tenders shall remain valid and open for acceptance for a period of 3 (Three) months from the date of opening price bid. If the tenderer withdraws his/her offer during the validity period or makes modifications in External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha

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his/her original offer which are not acceptance to the Bank without prejudice to any other right or remedy the Bank shall be at liberty to forfeit the EMD.

10.0 Liquidated Damages

The liquidated damages shall be 0.5% per week subject to a maximum of 5% of contract value.

11.0 Rates and Prices: Percentage rate based tender

11.1 The bidders should submit their price bid in the online tendering portal within the stipulated timeline, failing which tender shall be summarily rejected. As the case is of Percentage Rate Tender, contractor has to quote rate in percentage below/above against Bank's total estimated cost (in figures as well as in words) given in Schedule of Quantities, to execute the work.

(a) The tender submitted shall be treated as invalid if:

1. The contractor does not quote percentage above/ below on the total amount of tender or any section/ sub head of the tender.
2. The percentage above/below is not quoted in figures & words both on the total amount of tender or any section/ sub head of the tender.
3. The percentage quoted above/below is different in figures & words on the total amount of tender or any section/ sub head of the tender.
4. Tenderers, whoever propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates, will be summarily rejected.

(b) The intending bidders shall be asked to quote their offers in terms of "specific Percentage numerical value" (only up to two decimal places) above (+) / below (-) / at par (=) with the total Estimated Cost published for the project.

(c) After taking into account the Percentage Rebate/ Addition Offered by all the bidders on the Estimate Cost, "Net Tender Value" of each bidder shall be evaluated (Mostly by the online system itself) and the bidder offering Lowest Tender Amount for projects pertaining to Procurement Purchase Contract and Highest Tender Amount for Sales Contracts shall be declared as "Successful Bidder".

(d). The "Percentage Offer" shall be uniformly applicable to each and every item including all sections/ sub sections/sub heads of the Tender.

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(e). In case, the Lowest Tendered Amount (i.e. Estimated cost +/- Percentage Bid quoted) of two or more contractors is same, such lowest contractors will again be asked to submit sealed /online "Revised +/- Percentage (%) offers" on the original Estimated cost of tender including all sub sections/sub heads excluding fixed rate items as the case may be, but the revised percentage quoted shall, in no case, be higher than the percentage quoted during their initial offer for the project. The lowest tender shall be decided on the basis of revised offers.

(f). The process of online re-bidding amongst two or more contractors offering same percentage rates tendering process shall continue till L-1 bidder is discovered, which may be conducted in same or next working day. However, revised offer cannot be more than initial/previous offer.

(g). In case, any of such contractor(s) (quoted same tender amount during initial bidding or subsequent re-bidding) refuses to submit revised offer, it shall be treated as "**withdrawal of tender**" by the Contractor before acceptance and the EMD of such contractors shall be forfeited.

(h) In case all the lowest contractors who have quoted same tendered amount, refuse to participate in online revised bidding process for the project, the EMD of all such Contractors shall be forfeited and the tenders for the project shall be invited afresh.

(i). The Contractor(s), whose earnest money is forfeited because of non-submission of revised offer, shall not be allowed to participate in the re-tendering process for the said project.

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

11.1.2 The tenderers should not change the units as specified in the tender. If any unit is changed the tenders would be evaluated as per the original unit and the contractor would be paid accordingly.

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

11.1.3 The rate quoted shall be firm and shall include all costs, allowances, transportation, taxes, cess, royalties, levies, excluding GST etc.

E-TENDERING INSTRUCTIONS TO BIDDERS

General:

State Bank of India hereby publishes the TENDER on the e-tendering Portal (Website) <https://etender.sbi> in Electronic mode hereinafter referred as “e Tendering” and TENDER will be hereunder called “e-Tender”. The e-tender published online through the above portal (website) consists standard tender conditions, specifications, schedule of quantities, drawings (if any) for above referred work. Please note that copy of the above e-tender can be downloaded from above portal (website) and should be mandatorily submitted in online Electronic Mode hereinafter referred as “Online Offer”. The submission of the online offer duly Encrypted & Digitally signed on above portal should be in prescribed Electronic Forms (Online) available on above portal for respective tender in Online Envelope(s) on or before as per the key Dates mentioned in the Tender Notice in this document and online portal for above tender.

Instructions:

1. Tender Bidding Methodology:

Electronically Sealed Bid System – Two - Stage – Technical Bid and Price Bid, in percentage rate tendering process on price bid. Firstly, a technical bid will be opened and after technical evaluation, suitable agencies will be shortlisted. The Price bid (Financial bid) will be opened to only those agencies who qualify in the technical bid.

2. Broad outline of activities from Bidders prospective:

- 1.0 Procure a Digital Signing Certificate (DSC)
- 2.0 Register on the e-Procurement portal <https://etender.sbi>
- 3.0 (The contractors need to upload scan copy of their valid empanelment letter in the portal otherwise their registration would be cancelled)
- 4.0 Create Users and assign roles on the above portal
- 5.0 View Notice Inviting Tender (NIT) on the above portal
- 6.0 Download Official Copy of Tender Documents from the above portal
- 7.0 Clarification to Tender Documents on the above portal
- 8.0 Bid-Submission on the above portal
- 9.0 Attend Public/Limited Online Tender Opening Event (TOE) on the above portal-Opening of Technical-Part
- 10.0 Post-TOE Clarification on the above portal (Optional) – Respond to SBI's Post-TOE queries
- 11.0 Attend Public/Limited Online Tender Opening Event (TOE) on the above portal – Opening of Financial-Part (Only for Technical Responsive Bidders)

3. Digital Certificates

For integrity of data and authenticity/ non-repudiation of electronic records, and to be compliant with IT Act 2021, it is necessary for each user to have a Digital Certificate (DC). also referred to as Digital Signature Certificate (DSC), of Class II or above, issued by a Certifying Authority (CA) licensed by Controller of Certifying Authorities (CCA) [refer <http://www.cca.gov.in>].

4. Registration

To use the Electronic Tender portal <https://etender.sbi> vendors need to register on the portal. Registration of each organization is to be done by one of its senior persons vis-a-vis

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Authorized Signatory who will be the main person coordinating for the e-tendering activities. In the above portal terminology, this person will be referred to as the Super User (SU) of that organization. For further details, please visit the website/portal, and follow further instructions as given on the site.

Note: After successful submission of Registration details please contact to the Helpdesk of the portal to get your registration accepted/activated.

**Sujith Nair | Dy. Manager – Client Service
e-Procurement Technologies Limited**

Address: B-704, Wall Street – II, Opp. Orient Club, Ellisbridge, Ahmedabad – 380006, Gujarat, India

Contact: sujith@eptl.in | Phone: 9904407199

mubassera@eptl.in | Phone: 7859800621

Office Hours: (Monday – Friday: 10:00 AM – 7:00 PM (IST), Saturday: 10:00 AM – 6:00 PM (IST))

(Exclusion: Sunday, Holidays and 2nd & 4th Saturday)

To Know eTender submission Process – Click Here : - [eTender Submission Guidance Video](#) . (Note : This is General Process of eTender, It may be Vary As per Tenderer Requirement).

5. Bidding related Information for this Tender (Sealed Bid)

The entire bid-submission would be online on the portal. Broad outline of submissions are as follows:

- Submission of Bid Security/ Earnest Money Deposit (EMD) & Cost of Bid Document, if any.
- Submission of digitally signed copy of Tender Documents/ Addendum
- Power of Attorney, • Two Envelopes, - Technical-Part, Each of the above electronic envelopes consists of Main bid and Electronic form (both mandatory) and bid Annexure (Optional).

NOTE: Please note that above e-Tendering system is an automatically time locked system which will be locked immediately as soon as due date and time is over and will not accept any offer after that. So, the tenderers are strictly advised to do their process well before the due date and time to avoid any such instances.

6. Tender Opening Event (TOE):

The e-Procurement portal offers a unique facility for 'Public/Limited Online Tender Opening Event (TOE)'. Tender Opening Officers as well as authorized representatives of bidders can attend the Public/Limited Online Tender Opening Event (TOE) from the comfort of their offices. For this purpose, representatives of bidders (i.e. Supplier organization) duly authorized are requested to carry a Laptop and Wireless Connectivity to Internet. Every legal requirement for a transparent and secure 'Public/Limited Online Tender Opening Event (TOE)' has been implemented on the portal. As soon as a Bid is decrypted with the corresponding 'Pass-Phrase' as submitted online by the bidder himself (during the TOE itself), salient points of the Bids are simultaneously made available for downloading by all participating bidders. The tedium of taking notes during a manual 'Tender Opening Event' is

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therefore replaced with this superior and convenient form of 'Public/Limited Online Tender Opening Event (TOE)'. The portal has a unique facility of 'Online Comparison Chart' which is dynamically updated as each online bid is opened. The format of the chart is based on inputs provided by the Buyer for each Tender. The information in the Comparison Chart is based on the data submitted by the Bidders. A detailed Technical and/ or Financial Comparison Chart enhance Transparency. Detailed instructions are given on relevant screens. The portal has a unique facility of a detailed report titled 'Minutes of Online Tender Opening Event (TOE)' covering all important activities of 'Online Tender Opening Event (TOE)'. This is available to all participating bidders for 'Viewing/ Downloading'. There are many more facilities and features on the portal. For a particular tender, the screens viewed by a Supplier will depend upon the options selected by the concerned Buyer.

IMPORTANT NOTE: In case of internet related problem at a bidder's end, especially during 'critical events' such as – a short period before bid-submission deadline, during online public/limited tender opening event, during e-tender, it is the bidder's responsibility to have backup internet connections. In case there is a problem at the e-procurement/ e-tender service-provider's end (in the server, leased line, etc.) due to which all the bidders face a problem during critical events, and this is brought to the notice of SBI by the bidders in time, then SBI/SBI will promptly re-schedule the affected event(s).

7. Minimum Requirements at Bidders end:

In order to operate on the electronic tender management system, the user's machine is required to be set up. The machine must have running XP service Pack 3 or higher version of Windows like Vista or Window 7. Also need to install Mozilla Fire fox web browser and latest Version of Java.

8. Please follow below steps to open Internet Explorer mode in Microsoft Edge.

- Open Microsoft Edge > click on "settings" > click on Default browser
- Let Internet Explorer open in Microsoft Edge change it from "**Always**" to "**Incompatible sites only (Recommended)**".
- Allow sites to be reloaded in Internet Explorer mode > "**Allow**"
- Internet Explorer mode pages > click on "Add" > Enter a URL: <https://etender.sbi>
- After make changes reopen Microsoft Edge & log in.

(For and behalf of Assistant General Manager)
SBI, LHO, Bhubaneswar

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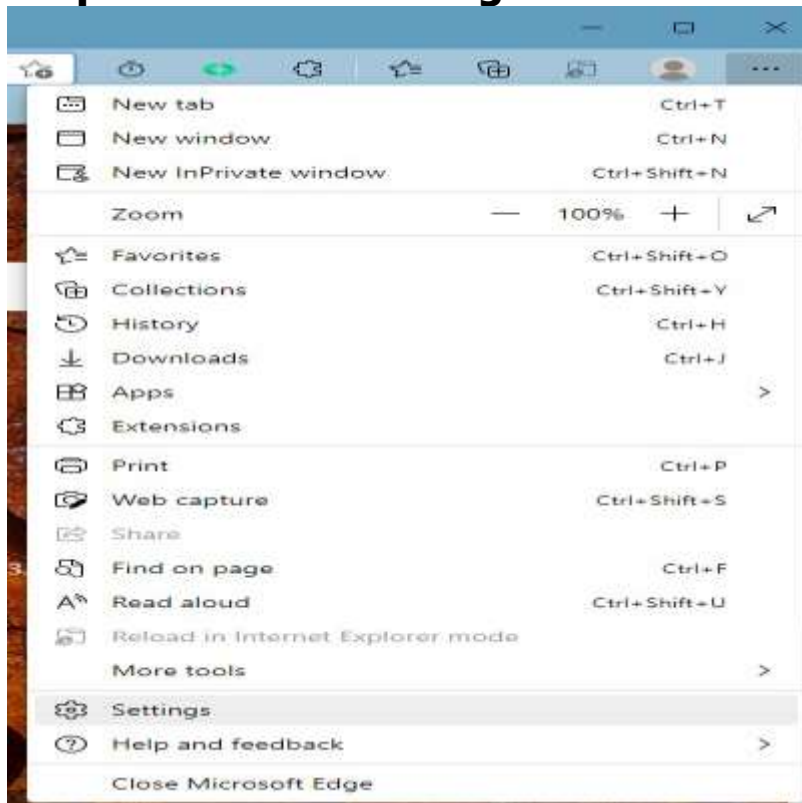
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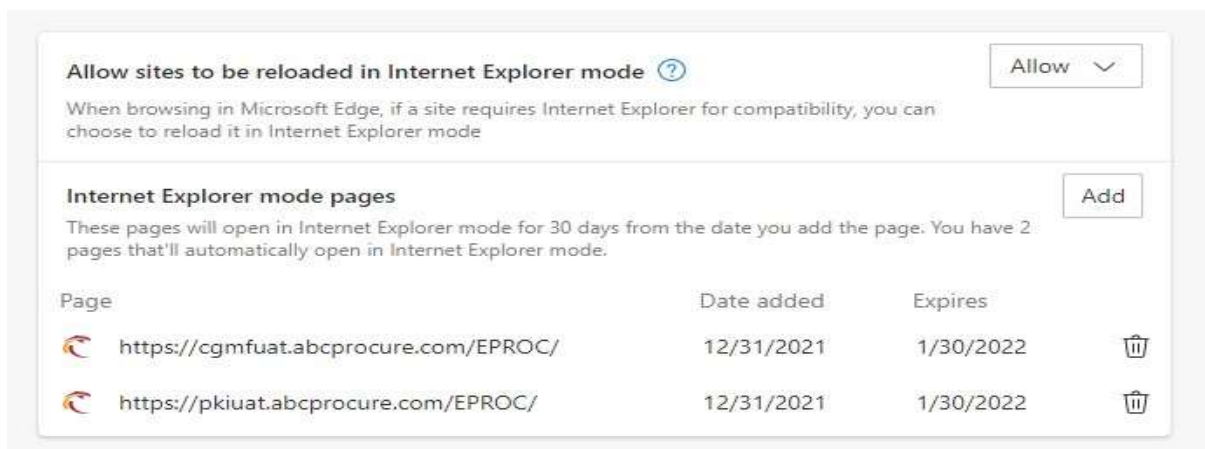
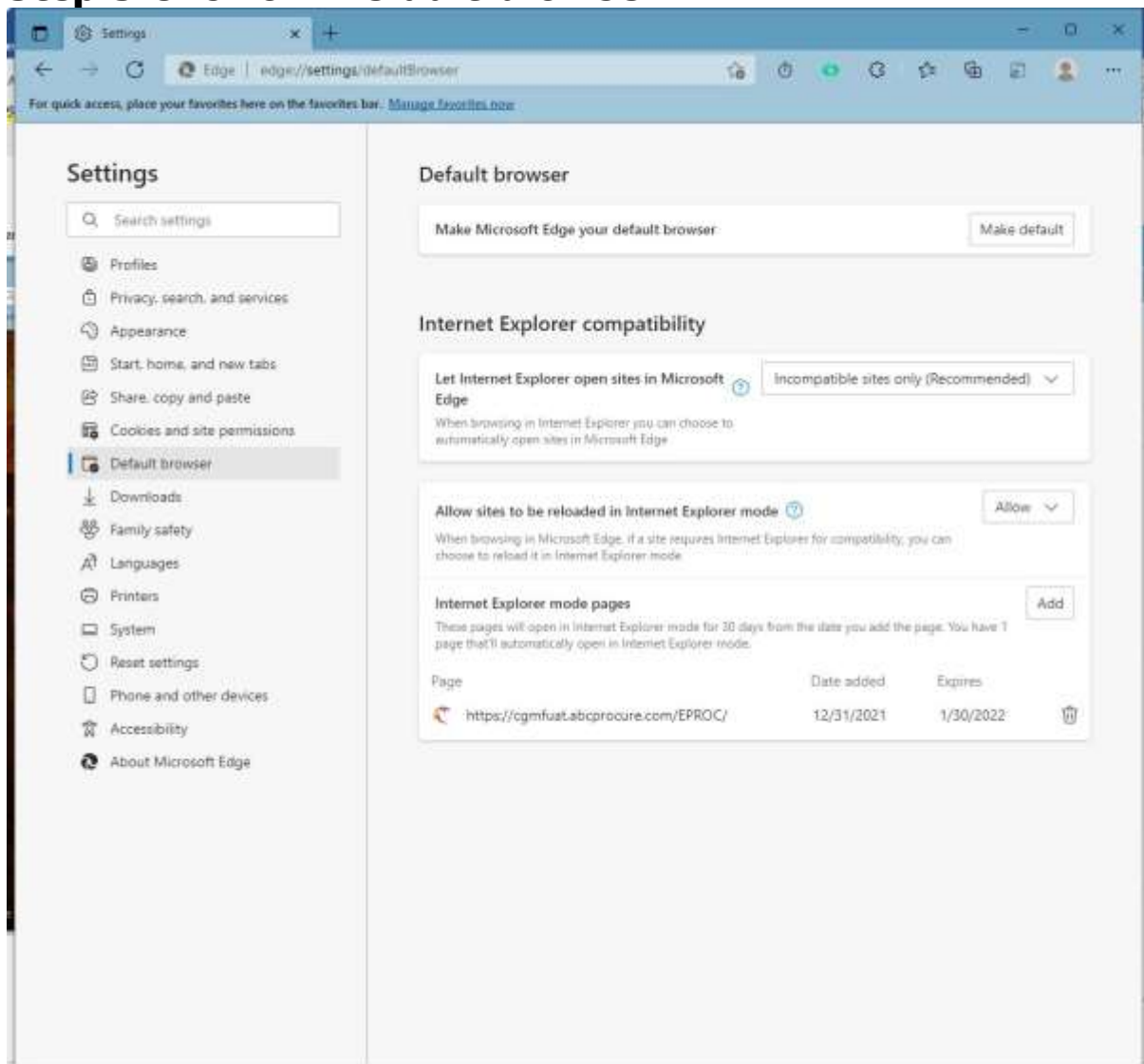
Step 1. Open Microsoft Edge browser



Step 2. Click on Settings

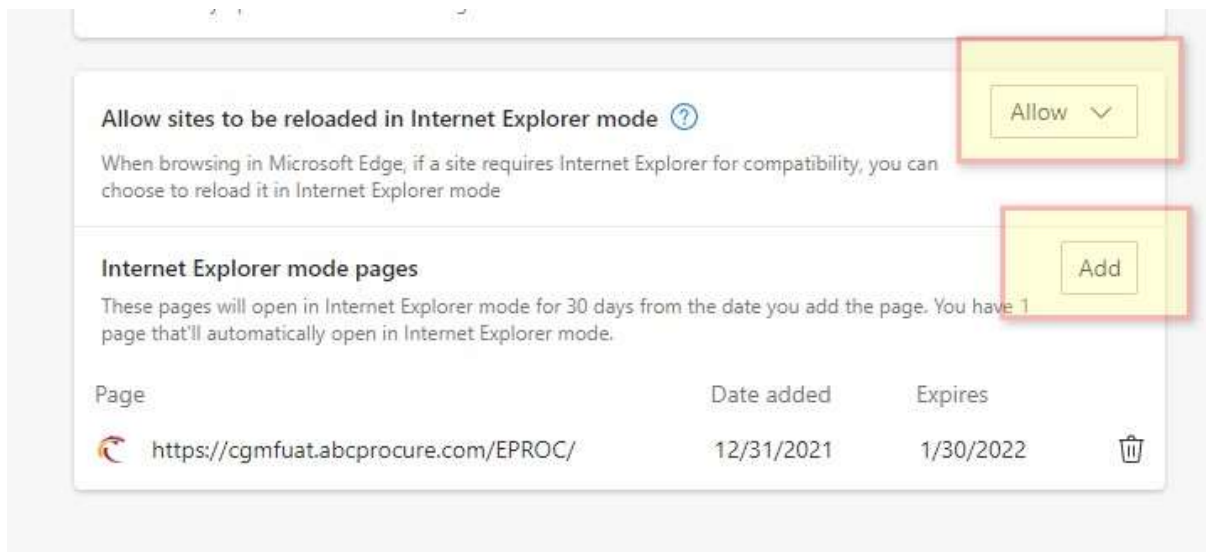


Step.3 Click on 'Default browser'

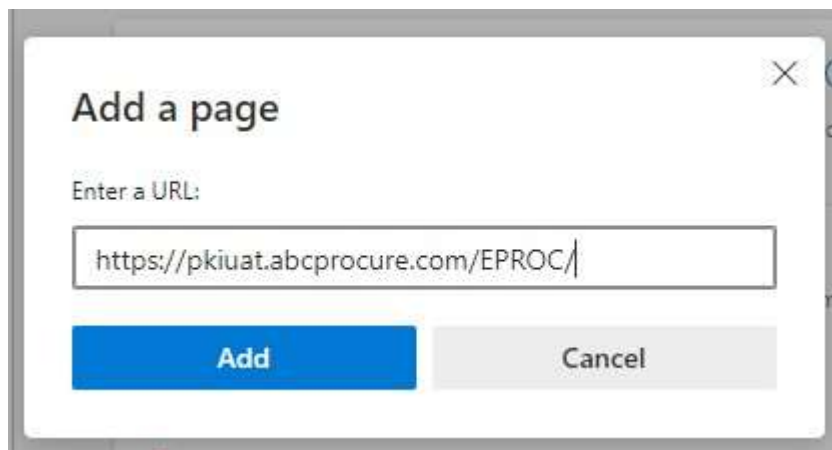


Step 4. Configure URL in Internet Explorer mode

- Allow sites to be reloaded in Internet Explorer mode = Allow
- Click on Add button

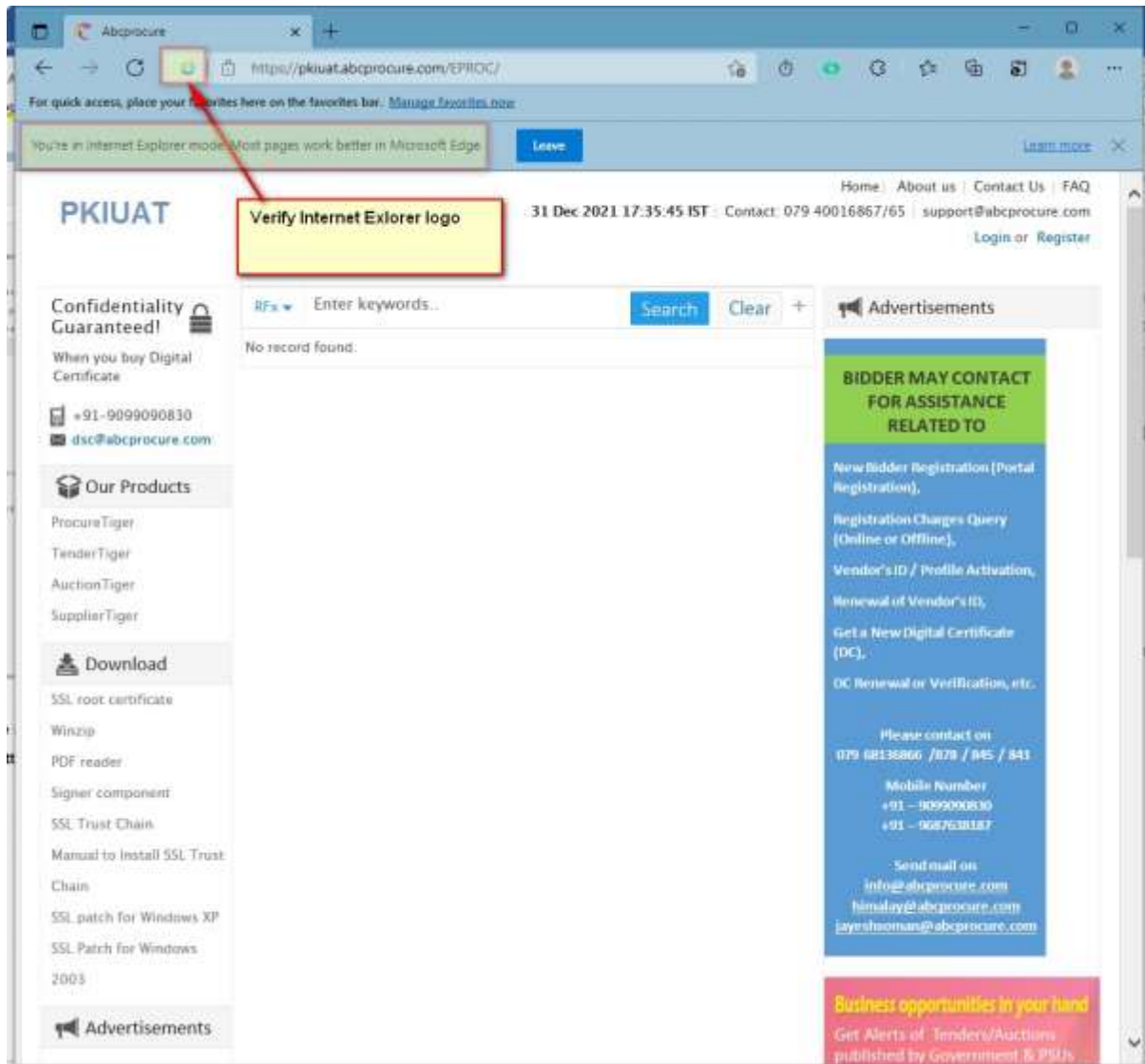


- Add URL



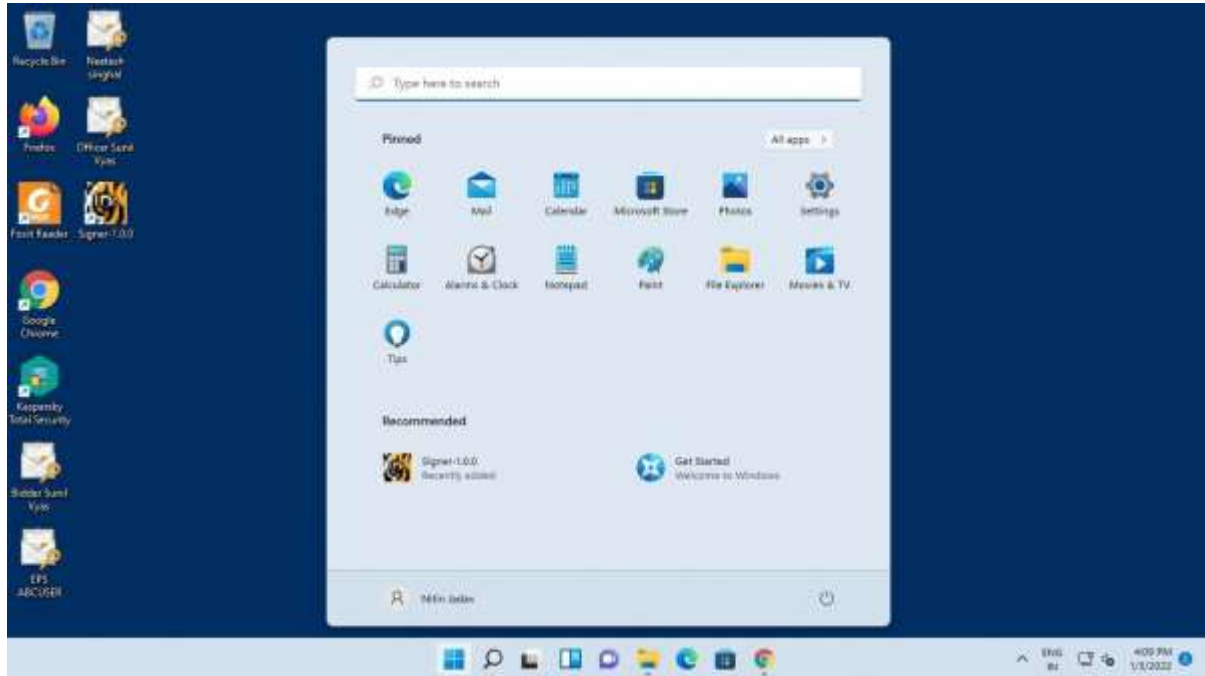
Step 5. Restart the browser and open URL.

Verify it is opened in Internet Explorer mode by logo and notification

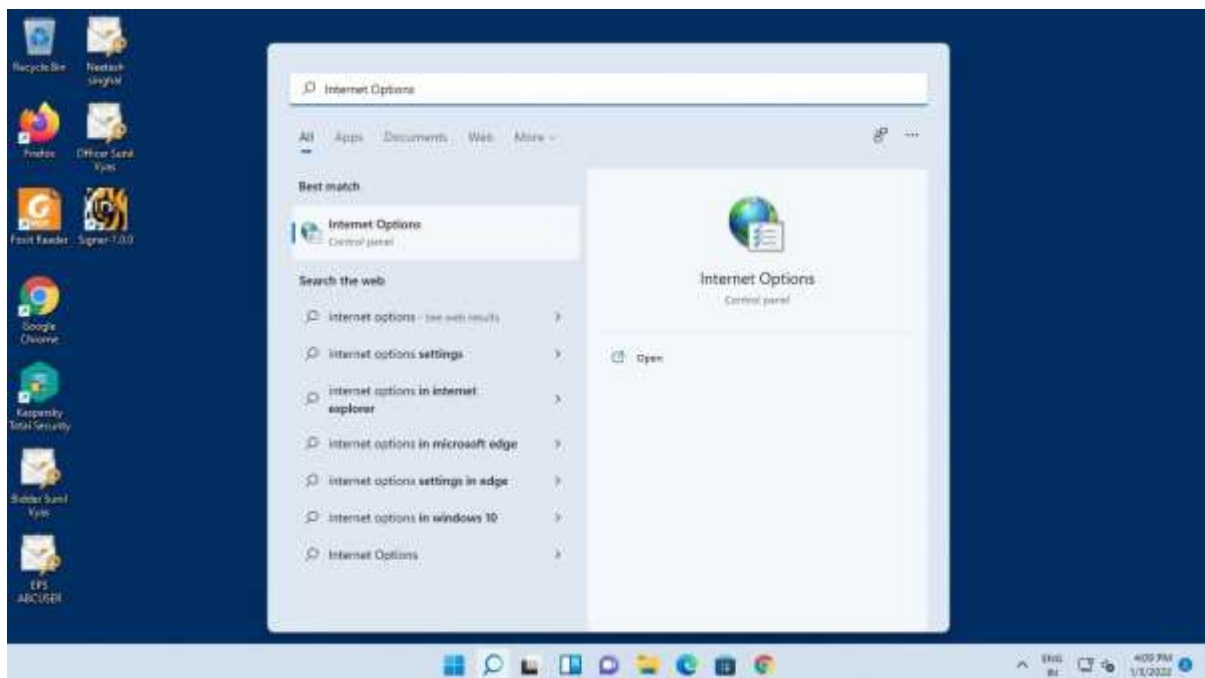


Step 6. Configure Internet Option:

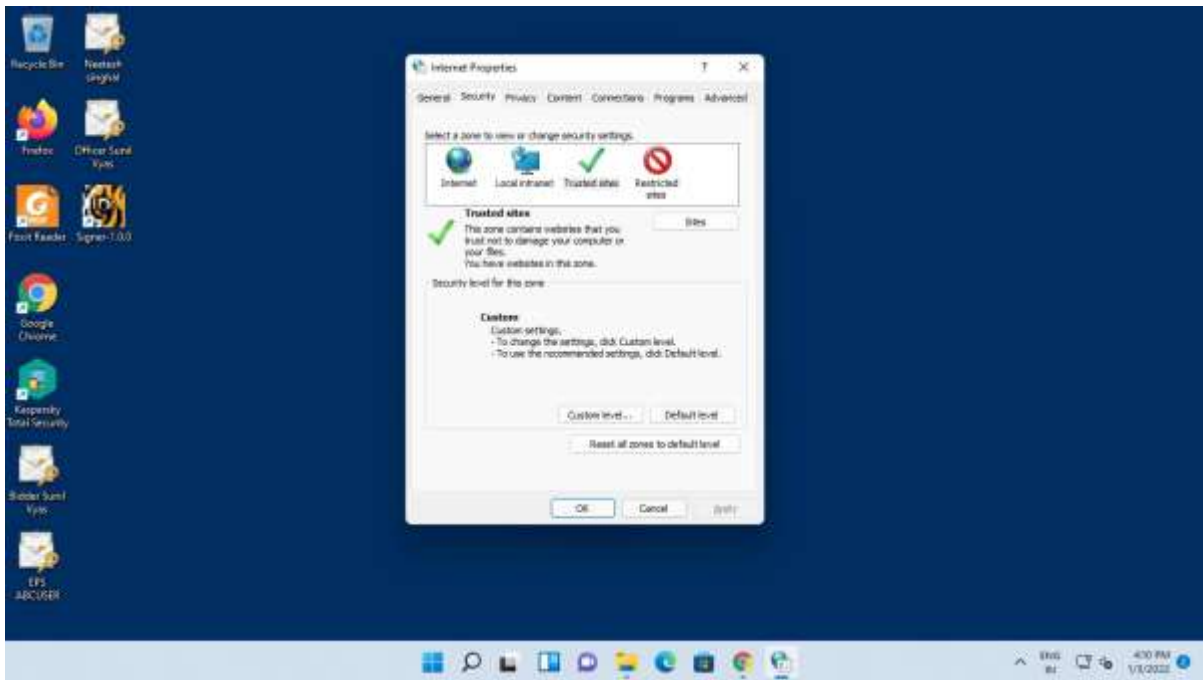
6.1 Click on Windows button / Start Menu



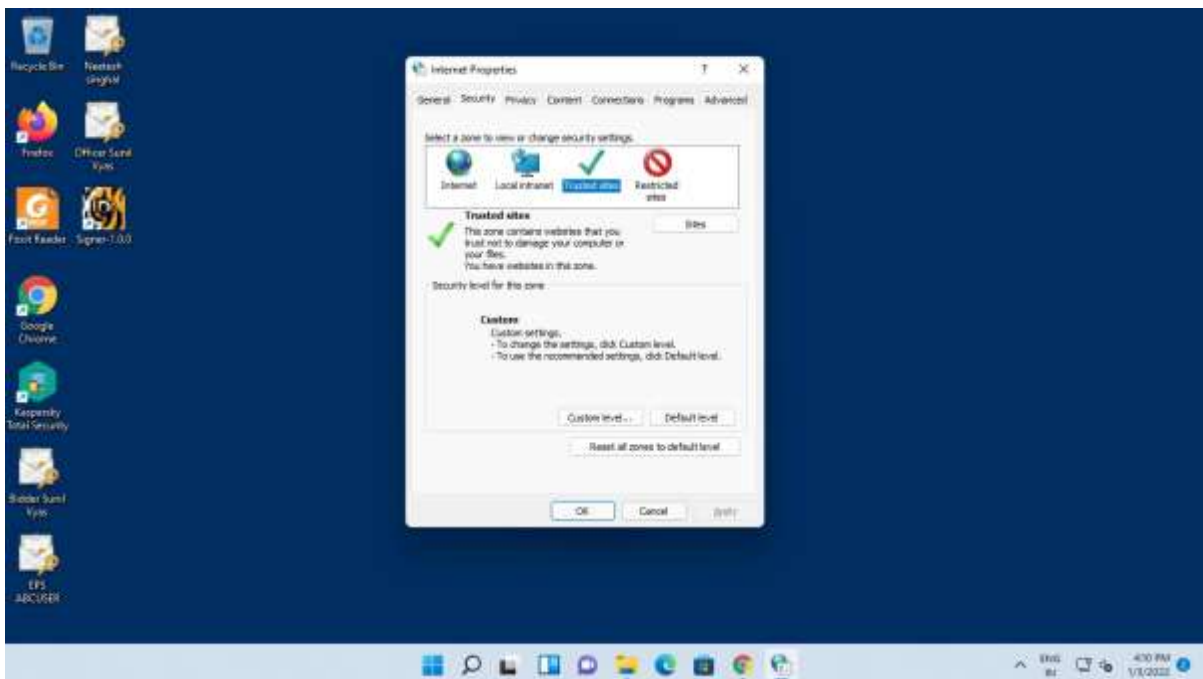
6.2 Search "Internet option" and Click on Open



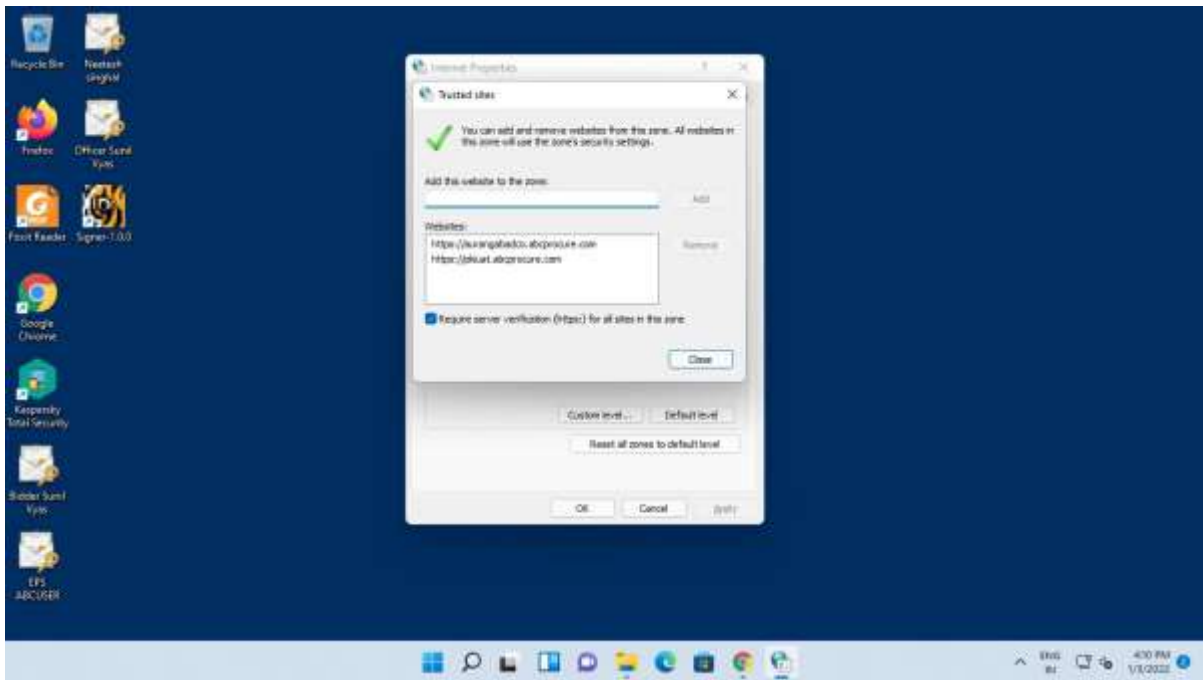
6.3 Click on "Security" Tab



6.4 Select "Trusted site" Icon and Click on "Sites" Button



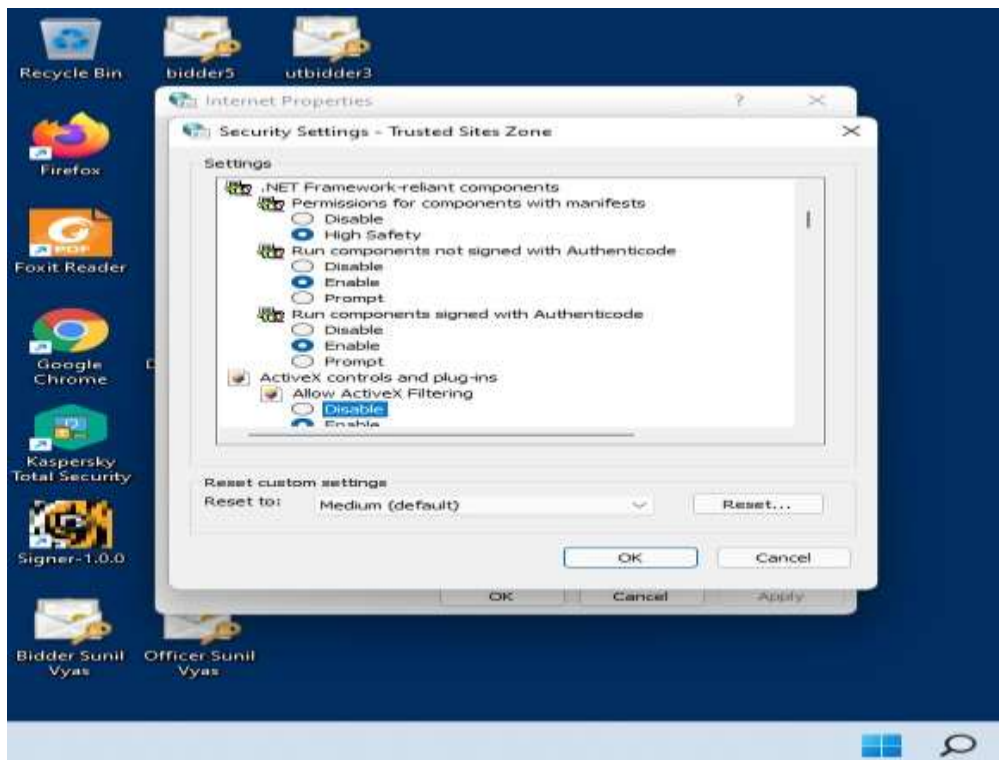
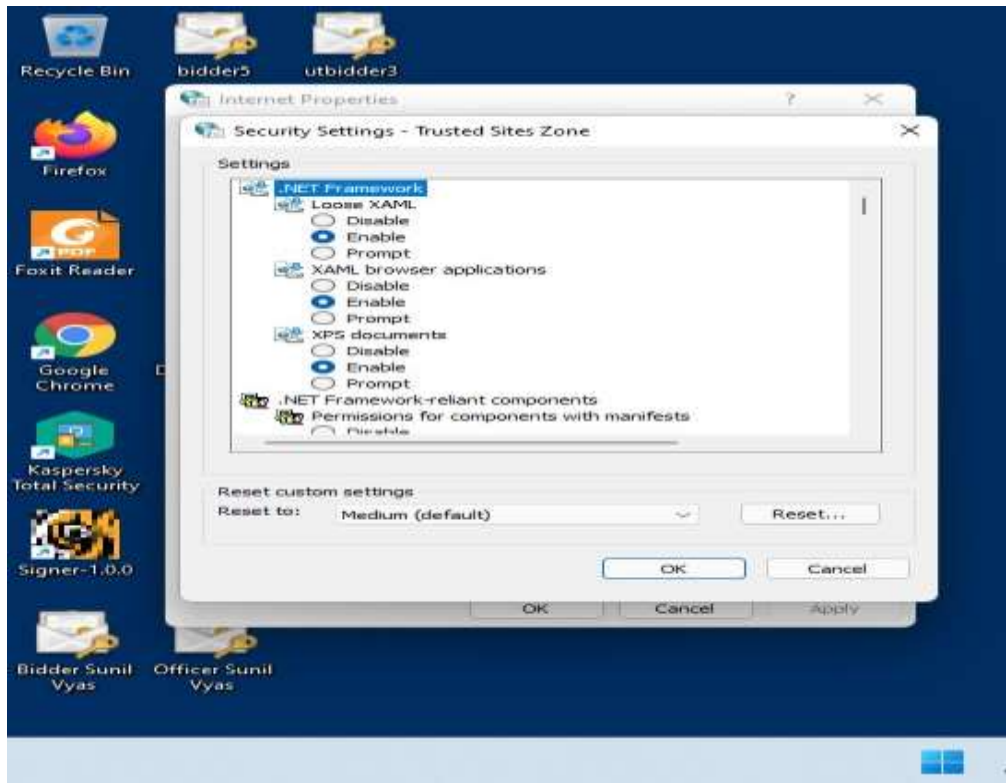
6.5 Click on “Add” button to Enter “Web URL” in Trusted List

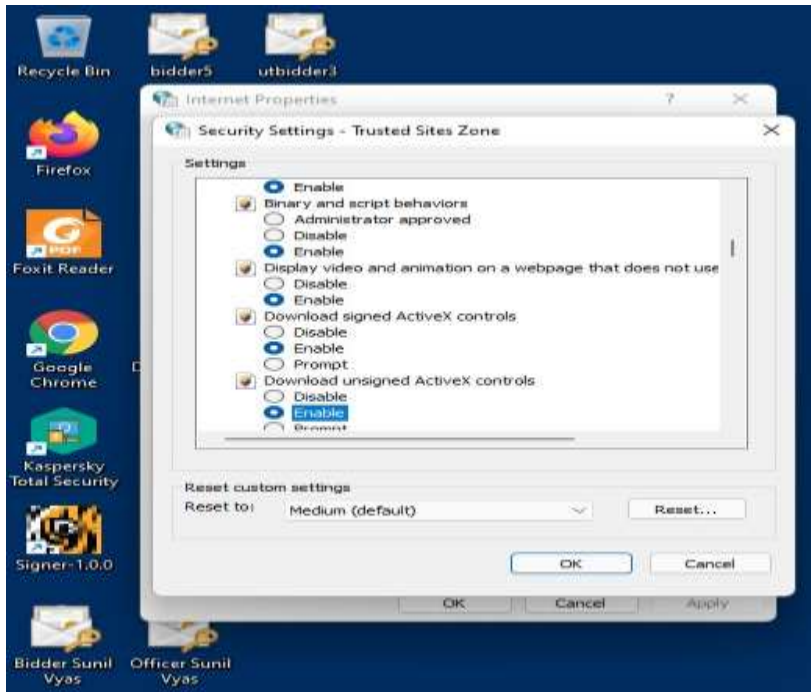
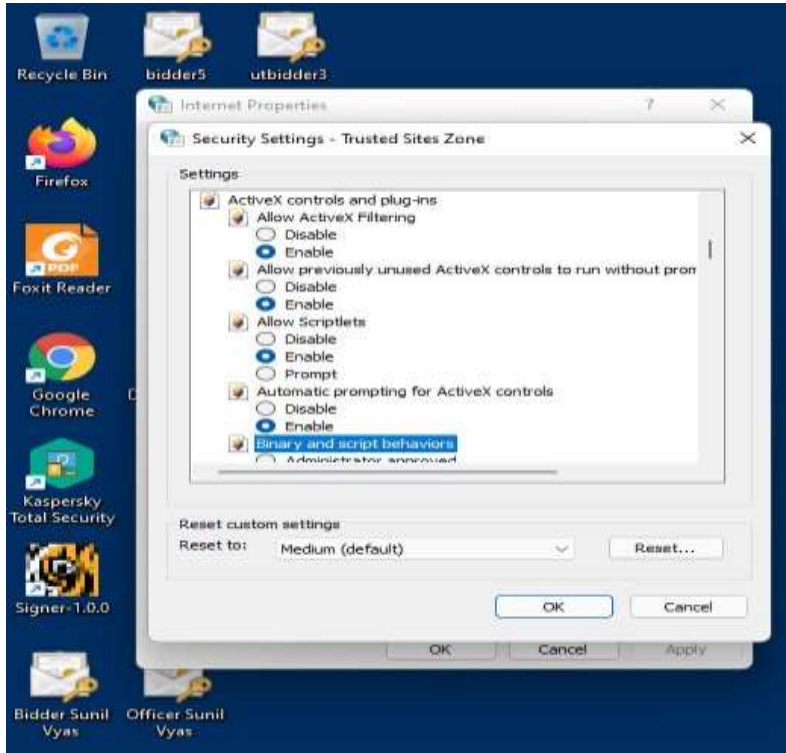


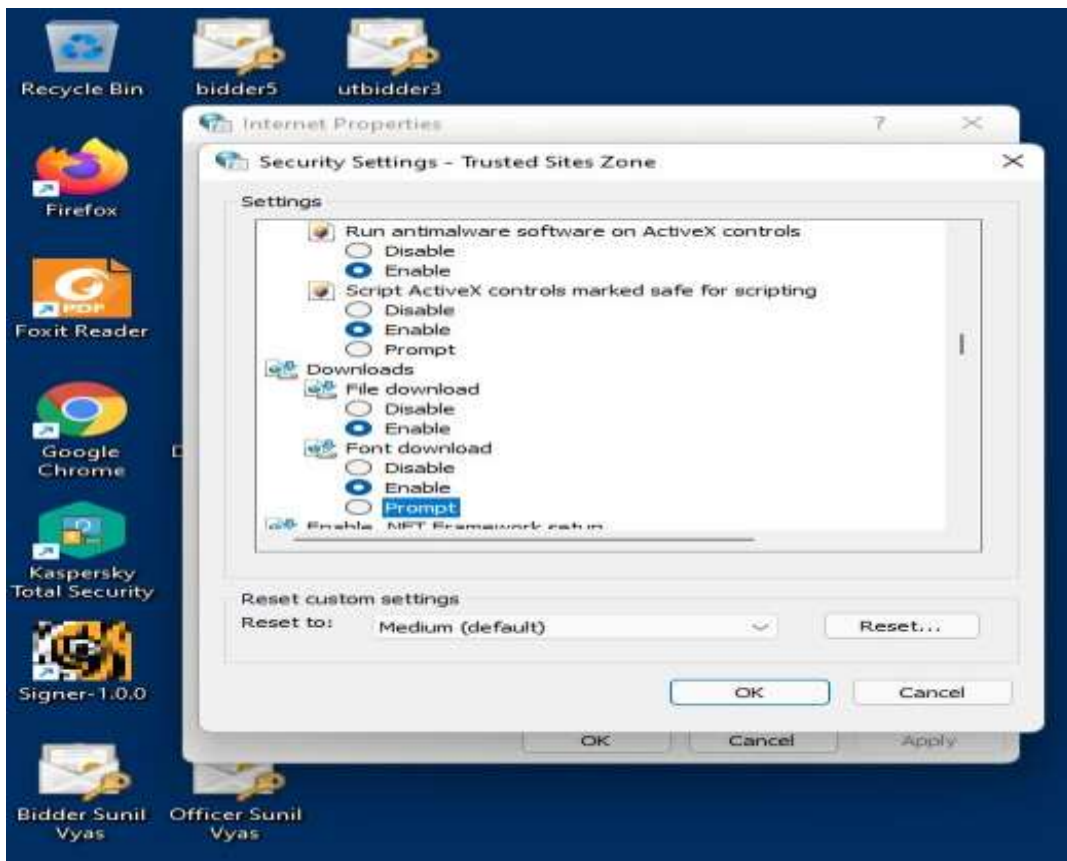
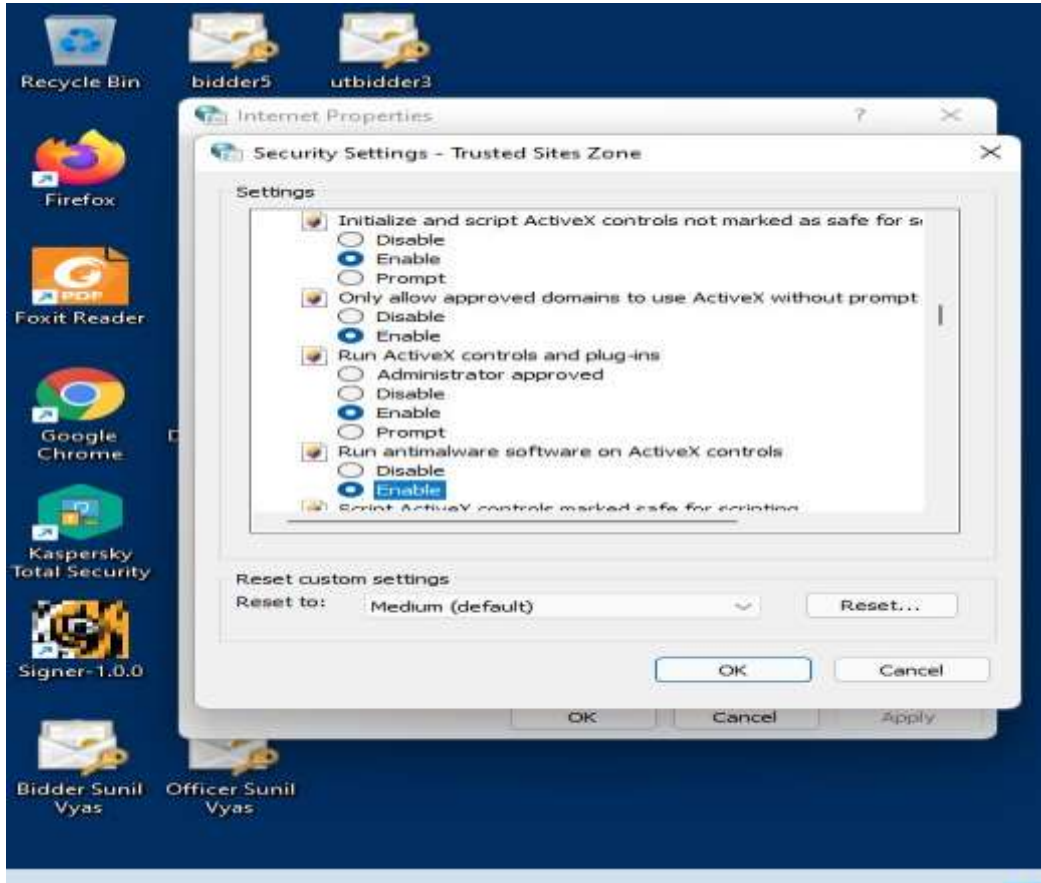
6.6 Click on “Custom Level” Button

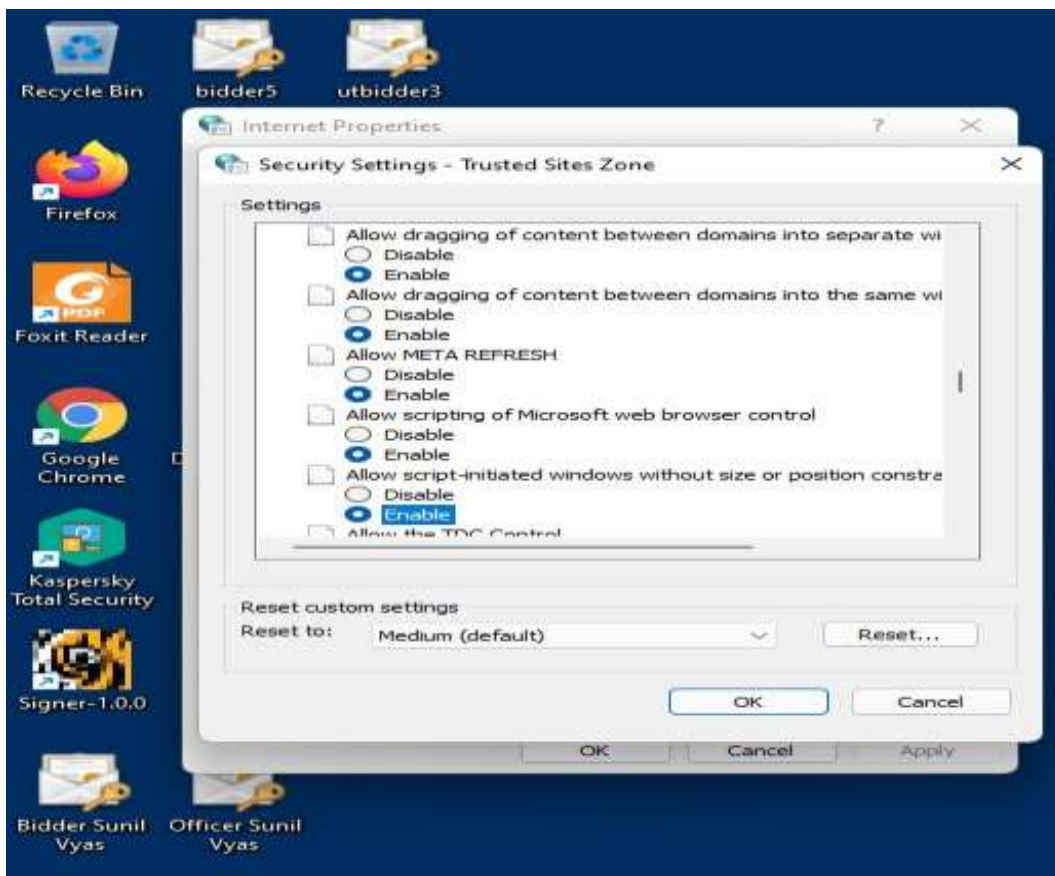
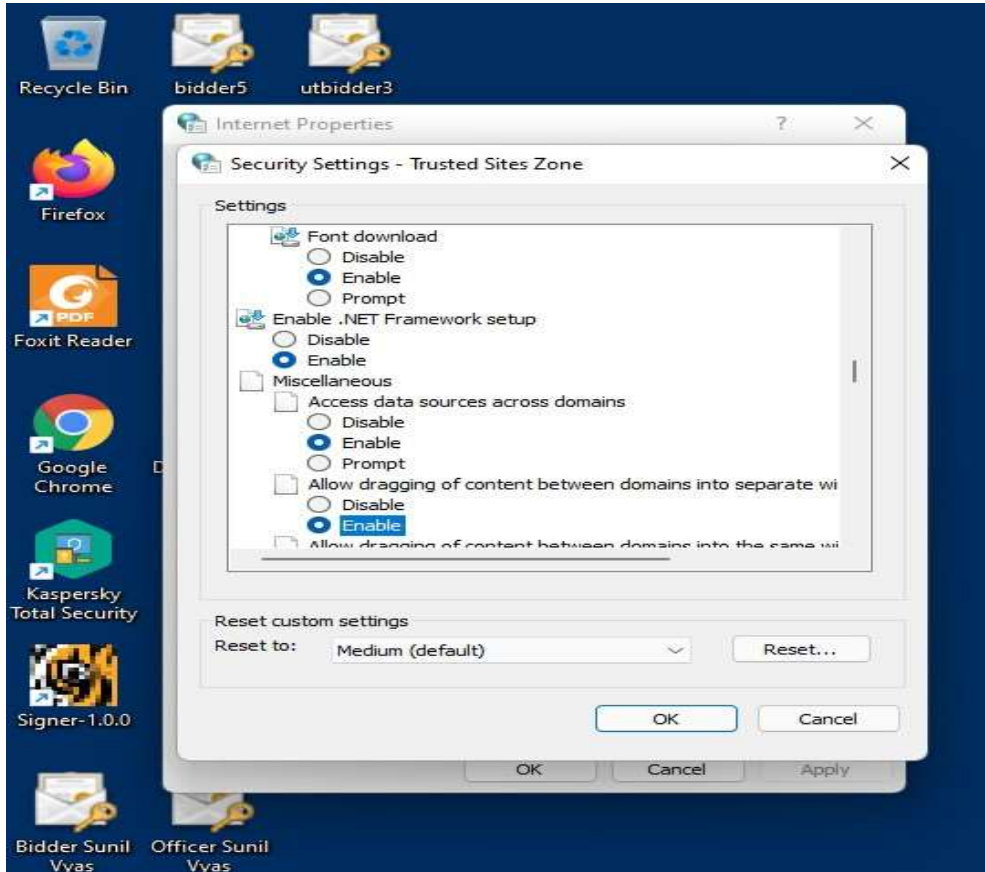


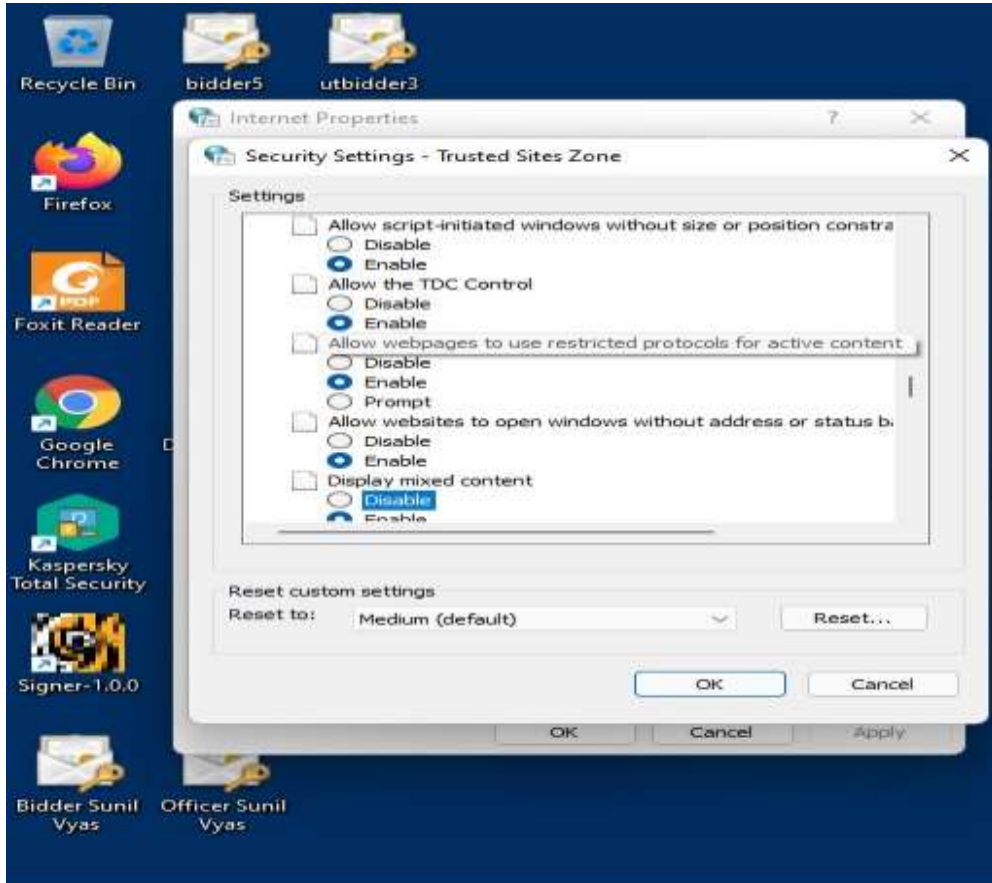
6.7 Configure settings of choice and Click on 'OK" button

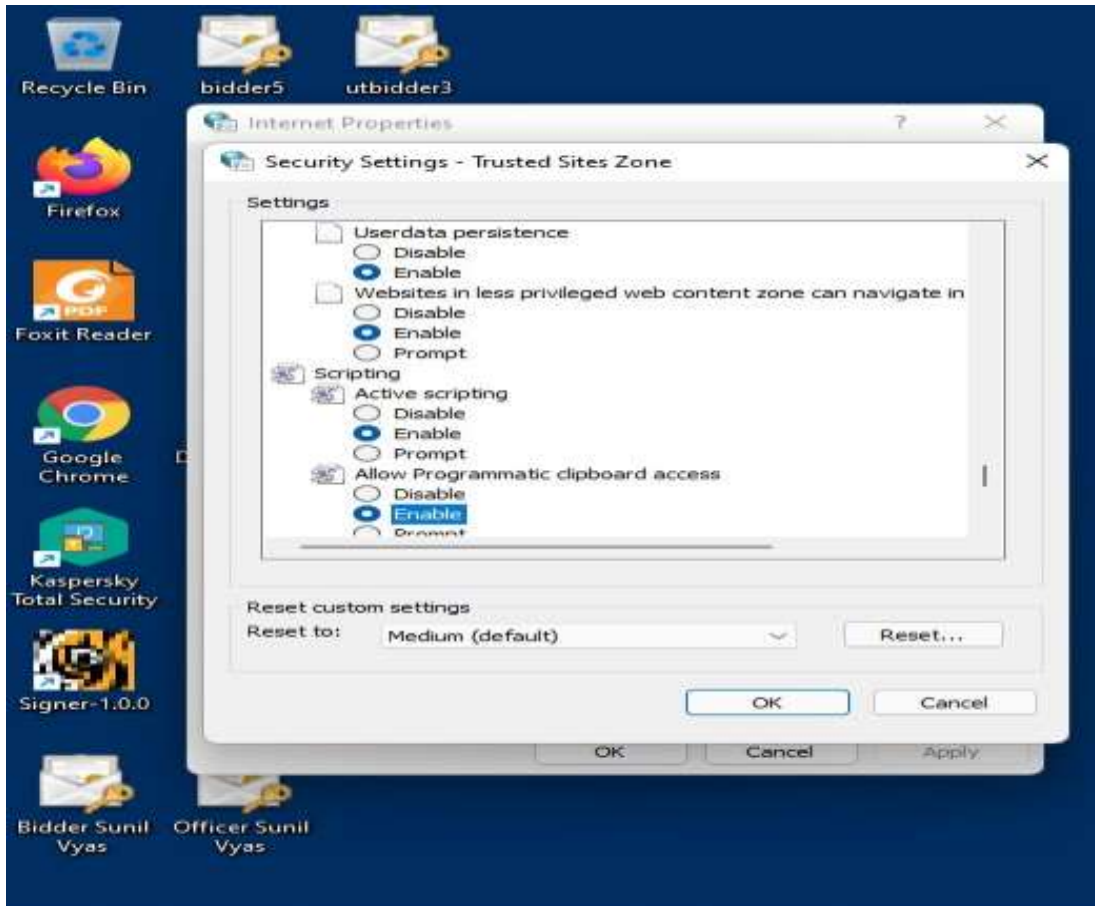
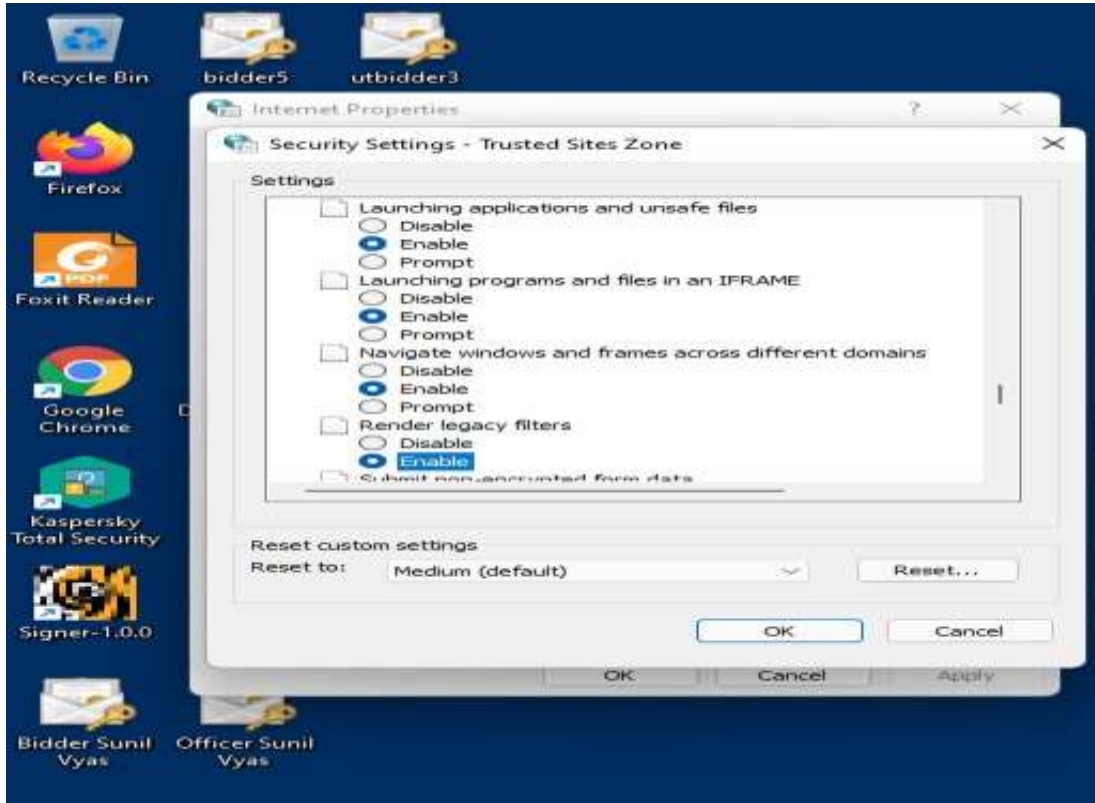












PROCESS COMPLIANCE STATEMENT

Annexure- 1

(The bidders are required to print this on their company's letterhead and sign, stamp it before emailing/submission online.)

M/s e-Procurement Technologies Limited
B-704, Wall Street – II, Opp. Orient Club,
Ellisbridge, Ahmedabad – 380006, Gujarat, India
Email ID: sujith@eptl.in

Agreement to the Process Related Terms and Conditions for the on-line e – tendering for “External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha”.

Dear Sir,

This has reference to the Terms & Conditions for the E-tendering mentioned in the Tender document. This letter is to confirm that:

- 1) The undersigned is authorized representative of the company.
- 2) We have studied the Commercial Terms and the Business rules governing the E-tendering as mentioned in Tender of SBI as well as this document and confirm our agreement to them.
- 3) We also confirm that we have taken the training on the E-tendering tool and have understood the functionality of the same thoroughly.
- 4) We confirm that SBI and M/s. **e-Procurement Technologies Limited** shall not be liable & responsible in any manner whatsoever for my/our failure to access & bid on the e-E-tendering platform due to loss of internet connectivity, electricity failure, virus attack, problems with the PC, any other unforeseen circumstances etc. before or during the E-tendering event.
- 5) We confirm that we have a valid digital signature certificate issued by a valid Certifying authority.
- 6) We, hereby confirm that we will honour the Bids placed by us during the E-tendering process.

With regards,

Date:

Name:

Company / Organization:

Designation within Company / Organization: Address of Company / Organization:

Scan it and send to this Document on -----

To,
AGM (P&E),
State Bank of India, Local Head Office,
III/1, Pt. J.N.Marg, Bhubaneswar.
Dear Sir,

EXTERNAL & INTERNAL RENOVATION OF LHO BUILDING (2ND TO 5TH FLOOR), BHUBANESWAR, ODISHA

I/We refer to the tender notice issued by you for **External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha**, in connection with above subject.

1. I/we have satisfied myself/ourselves as to the site conditions examined the drawings and all aspects of the tender conditions subject to above, I/We do hereby agree should this tender be accepted in whole or part of:
 - a. Abide by and fulfil all the terms and provisions of the said conditions annexed hereto:
 - b. Complete the work within the timeline as stipulated in two or three shifts if considered necessary by the consultants/ architects at no extra cost to the bank,
2. I/we have deposited the earnest money of **Rs. 19,29,000.00** which we note will not bear any interest and is liable to forfeiture,
 - i. If the offer is withdrawn within the validity period of acceptance or
 - ii. If the contract is not executed within 15 days from award of contract, or
 - iii. The acceptance of this tender shall constitute a breach of contract by us & the tender accepting authority shall be entitled to have the work executed at our risk and cost and to claim extra cost/expenditure incurred by then from us
3. Unless and until a formal agreement is prepared and executed, this tender together with your written acceptance thereof shall constitute as a binding contract,
4. I/We understand that you are not bound to accept the lowest any tender received,
5. I/we have independently considered the amount of liquidated damages in the Appendix the General Conditions of contract and agree that it represents fair estimate of the loss likely to etc to be suffered by you in the event of the works not being completed in time,
6. Our bankers are: _____

The name of partners/ directors of the firm authorized to sign or name of persons having power of attorney to sign the contract (certified true copy of the power of attorney should be attached).

Yours faithfully

Signature of contractor/ authorized representative

Signature and address of witness (Mobile No and e mail address if any)

1.

2.

Notes to schedule items

1. Tenderers shall include their rates quoted for preliminary and general items required for the execution of work such as tools, plants, workman's shed, temporary offices, cleaning site, scaffolding up to the required height etc. The description of each item shall unless otherwise stated be held to include conveyance, labour, finishing to required shape and size, setting, fitting and fixing in position, straight cutting and wastes, return of packings, overheads, profits and other unless otherwise stated, be held to include the consequent waste.
2. The rates quoted by the contractor should cover for work at any height for all items of work under this contract. List of all materials will not form a criterion for any extra payment unless other contractors used in the particular item. In the event of arithmetical error/errors being discovered in the contract document, the rates mentioned in the words in tender copy marked original will only be taken as Bonafide.
3. Contractor should note that the tender **is strictly percentage rate based** and their attention is drawn to the fact that their rates for each and every item should be correct, workable and self-supporting. If called upon by architect/ Employer details analysis of any or all rates shall be bound to recognise contractors' analysis.
4. Contractor should note that their rates should be inclusive of all attendance on their sub-contractors and also for making good any holes and chases left by the sub-contractor before the building work is completed.
5. The Contractor shall be responsible for procuring all required materials sufficiently in advance and see that the work is never hindered for meant of materials or due to any other reason or restriction.
6. The contractor shall have to carry out all connected work within the boundary of proposed work and inside the building if ordered to do so by the architect/ employer at the rate quoted in the schedule items.
7. The contractor is to study architectural drawings before commencing work. In case of discrepancy, the contractor must report to the architect/ employer immediately and shall get the same rectified before proceeding it.
8. The rate quoted for Electrical installation works shall include all necessary charges/requirements complying with Indian electricity act and rules in force for the work.
9. All works which shall be used in the work must be form the list of the approved materials as mentioned in the specification. Samples of materials proposed to be used shall be submitted to the Consultant/Bank for Approval.
10. General spirit of the technical specification and method of measurement shall be as laid down in the latest edition of I S code of practice. Rates quoted for all items shall include for the cost of supplying labour and materials fixing and erection complete with all the application necessary for proper execution and carrying out of the work to the truest sense of drawing and specification through this may not be mentioned in particular item of the schedule items.
11. The quoted rates shall include clearing site from all shrubs, vegetation, bushes, tress, before commencement of work even if not otherwise specified. Trees with girth of above 4500mm and measured 300mm above GL shall be cut with prior permission form Bank / consultant adhere to statutory norm/NOC from local Authority/Forest department, as applicable.
12. The quoted rate shall be deemed inclusive of costs, of all labour, materials, tools, plants Equipment, curing cost al lead and lift and all taxes, duties octroi even if these are not otherwise mentioned in items. GST shall be paid extra as applicable.

13. Products with ISI sample, if available shall be use with prior approval of the consultant/ employer reserves the right to select any particular brand between different state products of the same category.

ARTICLES OF AGREEMENT (DRAFT)

This agreement made theday of between Assistant General Manager (Premises & Estate), State Bank of India, Local Head Office, Bhubaneswar (hereinafter called the Bank or SBI) which expression shall include the successors and assigns) of the one part and M/s. company / partnership for registered under the Indian Companies Act/ Partnership Act having its registered office..... (hereinafter called 'the Contractors' which expression shall include the present directors / partners and also the directors / partners from time to time as also their respective heirs, legal representatives, administrators and assigns) of the other part.

WHEREAS the employer is desirous of execution of **Composite contractors for internal refurbishing (2nd to 5th floor) and allied civil works including external façade works, internal electrical & external works (It), fixed firefighting system, automatic fire detection & alarm system, public address and voice evacuation system (basement-2 to 6th floor), telecom & data cabling works at existing Iho building at Bhubaneswar, Odisha.** (Name of work) and has caused drawings and specifications describing the works to be done prepared by Project Architect **M/s Architect Narayan & Associates Private Limited (ANAPL), Mumbai** having their offices at 304 3rd Floor, Antariksh building, Makhawana Road, Marol Andheri East, Mumbai 400059 (hereinafter called "the Architect").

AND WHEREAS THE SAID Drawings numbered as mentioned in the tender documents hereinafter mentioned and to be issued from time to time, the specifications and the Schedule of items and quantities have been signed by or on behalf of the parties hereto.

AND whereas the contractors have agreed to execute upon and subject to the condition set forth herein and Schedule of items and quantities, General & special Conditions of Contract, specification etc. contained in the tendered documents including all correspondences exchanged by or between the parties from the submission of tender till the award of work, both letters inclusive, (all of which are collectively hereinafter referred to as "the said conditions"). The works shown upon the said drawing and /or described in the said specification and included in the schedule of Items and Quantities at the respective rates therein set forth amounting to the sum of Rs. _____ (Rupees _____ in words _____) as there in arrived at or such other sum as shall become payable there under (hereinafter referred to as "the said Contract Amount").

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the said Contract amount to be paid at the times and the manner set forth in the said Conditions, the Contractors shall upon and subject to the said conditions execute and complete the work shown upon the said drawings and described in the said specifications and the schedule of items and quantities.
2. The employer shall pay the Contractors the amount or such other sum as shall become payable, at the times and in the manner specified in the said conditions.
3. The term "the Architect" in the said condition shall mean the said "**M/s ANAPL**" or in the event of their ceasing to be the Architect for the purpose of this contract for whatever reason, such other person or persons as shall be nominated for that purpose by the Employer, not being a person to whom the Contractor shall object for

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha

Tender No.: BHU/P&E/10/2024-25/28 DATED 04.10.2024

reasons considered to be sufficient by the Employer provided always that no person or persons subsequently appointed to be Architect under this contract shall be entitled to disregard or over rule any previous decisions or approval or direction given or expressed in writing by the architect for the time being.

4. The said conditions and appendix thereto shall be read and construed as forming part of this agreement, and the parties hereto shall respectively abide by / submit themselves to the said conditions and perform the agreements on their part respectively in the said conditions contained.
5. The plans, agreement and documents mentioned herein shall form the basis of this contract.
6. This contract is neither a fixed Lump sum contract nor a piece work contract but is a contract to carry out the work in respect of the entire project on percentage rate basis to be paid for according to actual measured quantities at the rates contained in the schedule of quantities and rates or as provided in the said conditions.
7. The Bank / Employer reserves to itself the rights of altering the specifications and nature of work by adding to or omitting any item of work or having portions of the same carried out without prejudice to the contract.
8. Time shall be considered as the essence of this contract and the contractor here by agrees to commence the work soon after the site is handed over to him or from the 14th day after date of issue of formal work order as provided for in the said conditions of contractor whichever is later and to complete the entire work within ____ (period of contract) months subject never the less to the provisions for extension of time.
9. All payments by the Employer under this contract will be made only at Bhubaneswar.
10. Any dispute arising under this Agreement shall be referred to arbitration in accordance with the stipulations laid down in the tender.
11. That all the parts of this contract have been read by the contractor and fully understood by the contractor. They further agree to complete the said work to fullest satisfaction of architect / Employer.
12. IN WITNESS WHEREOF the Employer and the contractors have set their respective hands to these present through their duly authorized official and the said two duplicates hereof to be executed on its behalf of the day and year first herein above written.

Signed on behalf of the

Signed on behalf of the

STATE BANK OF INDIA

CONTRACTORS

In the presence of:

In the presence of:

1. Signature :

1. Signature :

Name :

Name :

Address :

Address :

In the presence of:

In the presence of:

2. Signature :

2. Signature :

Name :

Name :

Address :

Address :

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha

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GENERAL CONDITIONS OF THE CONTRACT

1.0 Definitions

“**Contract**” means the documents forming the tender and the acceptance thereof and the formal agreement executed between SBI and the contractor, together with the documents referred therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Architects/SBII and all these, documents taken together shall be deemed to form one contract and shall be, complementary to one another.

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

1.1.1 ‘**SBI / Bank**’ shall mean State Bank of India (client) a body Corporate created under SBI Act 1955, having one of its Circle Office at State Bank of India, III/1 Pandit Jawaharlal Nehru Marg, Bhubaneswar- 01 and includes the client’s representatives, successors and assigns.

1.1.2 ‘**Architects/Consultants**’ shall mean **M/s. Architect Narayan & Associates Private Limited, Mumbai**

1.1.3 ‘**Site Engineer**’ shall mean an Engineer appointed by the Bank/Architect as their representative to give instructions to the contractors

1.1.4 ‘**The Contractor**’ shall mean the individual or firm or company whether incorporated or not, undertaking the works and shall include legal personal representative of such individual or the composing the firm or company and the permitted assignees of such individual or firms of company.

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

1.1.6 ‘**Engineer**’ shall mean the representative of the SBI/Architect/consultant.

1.1.7 ‘**Drawings**’ shall mean the drawings prepared and issued by the Architects duly approved by the Bank and referred to in the specifications and any modifications of such drawings as may be issued from time to time ‘Contract value shall mean the value of the entire work as stipulated in the letter of acceptance of tender subject to such additions thereto or deductions there from as may be made under the provision hereinafter contained.

1.1.8 ‘**Specifications**’ shall mean the specifications referred to in the tender and any modifications thereof as maybe time to time be furnished or approved by the architect/consultant “Month” means s calendar month.

1.1.9 “**Week**” means seven consecutive days.

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1.1.10 “**Day**” means a calendar day beginning and ending at 00 Hrs and 24 hrs respectively.

1.1.11 “**SOQ/BOQ**” means as Schedule or Bill of Quantities.

1.1.12 “**SD**” means Security Deposit

1.1.13 “**ASD**” means Additional Security Deposit

1.1.14 “**BG**” means Bank Guarantee, which is to be arranged by the Composite Contractor from the Bank other than State Bank of India

1.1.15 “**MB**” may be read as Measurement Book

1.1.16 The project/work as stated in the tender “**COMPOSITE CONTRACTORS FOR INTERNAL REFURBISHING (2ND TO 5TH FLOOR) AND ALLIED CIVIL WORKS INCLUDING EXTERNAL FAÇADE WORKS, INTERNAL ELECTRICAL & EXTERNAL WORKS (LT), FIXED FIRE FIGHTING SYSTEM, AUTOMATIC FIRE DETECTION & ALARM SYSTEM, PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM (BASEMENT-2 TO 6TH FLOOR), TELECOM & DATA CABLING WORKS AT EXISTING LHO BUILDING AT BHUBANESWAR, ODISHA**”, may read and understood as “External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar”.

2. CLAUSES:

1.0 Total Security Deposit: Total Security deposit comprises of:

- Earnest Money Deposit
- Initial Security Deposit
- Retention Money

c) Retention Money: Total security deposit shall be 5% of the final value of the work. Out of this 2% of tender value (i.e. tender amount) is in the form of initial security deposit (ISD) which includes the EMD. Balance security deposit (i.e. 5% of final value of work less 2% of tender value already deposited as ISD) towards the work shall be deducted from the running account bill of the work as Retention money at the rate of 10% of the respective running account bill i.e. deduction from each running bill account will be 10% till total 5% of final value of work as per final bill is reached. 50% of the total security i.e. 2.5% of the final value of work shall be paid to the contractors on the basis of Project Engineer-in-Charge certifying the virtual completion and its approval by SBI. The balance 50% i.e. 2.5% of final value of work would be paid to the contractors after the defects liability period as specified in the contract and after satisfactory completion of CVC Audit. In case CVC Audit is not conducted, 1.25% of final value of work will be retained for a maximum period of further one year (w.e.f. completion of defect liability period).

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

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- i) Between scaled and written dimension (or description) on a drawing, the latter shall be adopted.
- ii) Between the written or shown description or dimensions in the drawings and the corresponding one in the specification the former shall be taken as correct.
- iii) Between written descriptions of the item in the specifications and descriptions in bills of quantities of the same item, the latter shall be adopted.
- iv) In case of a difference between rates written in figures and words, the rate in words shall prevail.
- v) Between the duplicate/subsequent copies of the tender, the original tender shall be taken as correct.

3.0 Scope of Work: The contractor shall carry out, complete, and maintain the said work in every respect strictly in accordance with this contract and with the directions of and to the satisfaction of the SBI /architect/consultant. The architect/consultant at the directions of the Bank from time to time issue further drawings and/or written instructions, details directions and explanations which are hereafter collectively referred to as SBI/Architect's instructions in regard to : the variation or modification of the design, quality or quantity of work or the addition or omission or substitution of any work, any discrepancy in the drawings or between the BOQ and/or drawings and/or specifications, the removal from the site of any material brought thereon by the contractor and the substitution of any other materials thereof, the demolition, removal and/or re-execution of any work executed by him, the dismissal from the work of any person employed/engaged thereupon.

4.0 (i) Letter of Acceptance: Within the validity period of the tender the SBI shall issue a letter of acceptance either directly or through the architect by registered post/e-mail/speed post or otherwise depositing at the address of the contractor as given in the tender to enter into a Contract for the execution of the work as per the terms of the tender. The letter of acceptance shall constitute a binding contract between the SBI and the contractor.

ii) Contract Agreement: On receipt of intimation of the acceptance of tender from the SBI/Architect the successful tenderer shall be bound to implement the contract and within fifteen days thereof, he shall sign an agreement in a non-judicial stamp paper of appropriate value (as per the Article of Agreement format earlier given in this document) with SBI.

5.0 Ownership of drawings: All drawings, specifications and copies thereof furnished by the SBI, through its architect/ consultants are the properties of the SBI. They are not to be used on other work.

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

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The work shall be executed in conformity therewith and the contractor shall prepare a detailed programme schedule (i.e. BAR/PERT Chart) indicating therein the date of start and completion of various activities on receipt of the work order and submit the same to the SBI through the Architect/Consultant.

7.0 Copies of Agreement: Out of Six copies, two copies of agreement/tender document duly signed by both the parties with the drawings shall be handed over to the contractors, two copies to SBI and one copy each shall be for the use of SBI and Architect.

8.0 Liquidated Damages: If the contractor fails to maintain the required progress in terms of contract or to complete the work and clear the site including vacating their office on or before the contracted or extended date or completion without justification in support of the cause of delay, he may be called upon without prejudice to any other right of remedy available under the law to the SBI on account of such breach to pay a liquidated damages at the rate of 0.5% of the final value of work per week subject to a maximum of 5% of the final value of work.

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

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

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

12.0 Protection of works and property: The contractor shall continuously maintain adequate protection, of all his work from damage and shall protect the SBI's properties from injury or loss arising in connection with contract. He shall make good any such damage,

injury, loss due to his fault or negligence except which are due to causes beyond his control.

He shall take adequate care and steps for protection of the adjacent properties. The contractor shall take all precautions for safety and protection of his employees on the works and shall comply with all applicable provisions of Government and local bodies' safety laws and relevant building codes to prevent accidents, or injuries to persons or property of about or adjacent to his place of work. The contractor shall take insurance covers as per clause 25.0 at his own cost. The policy may be taken in joint names of the contractors and the SBI and the original policy may be lodged with the SBI.

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

14.0 Assignment and subletting: The whole of work included in the contract shall be executed by the contractor and he shall not directly entrust and engage or indirectly transfer assign or underlet the contract or any part or share thereof or interest therein without the written consent of the SBI /SBI through the architect and no undertaking shall relieve the contractor from the responsibility of the contractor from active superintendence of the work during its progress.

15.0 Quality of Materials, Workmanship & Test: All materials and workmanship shall be best of the respective kinds described in the contract and in accordance with SBI/Architect's instructions and shall be subject from time to time to such tests as the SBI/Architect may direct at the place of manufacture or fabrication or on the site or an approved testing laboratory.

The quantity given in SOQ are intended to cover the entire new structure indicated in the drawing but the employer reserves the right to execute only a part or the whole or any excess thereof without assigning any reason thereof. Quantity not mentioned in the item will also be executed that are necessary to complete the work. The rate shall be derived as per prevailing market ate including CPOH 15%. The contractor shall provide such assistance, instruments, machinery, labour and materials.

Contractor to made arrangement of laboratory on site, where weight of various materials like aluminium extrusions etc. can be done, Contractor should also make available 3.00 meters, 15.00 meters & a 50.00 meters tape, a Vernier Calliper & Micrometre so any measurements/ tests can be taken on sites itself.

(ii)Samples: All samples of adequate numbers, size, shades & pattern as per specifications shall be supplied by the contractor without any extra charges. If certain items proposed to be used are of such nature that samples cannot be presented or prepared at the site detailed literature/test certificate of the same shall be provided to the satisfaction of

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the SBI/Architect. Before submitting the sample/literature the contractor shall satisfy himself that the material/equipment for which he is submitting the samples/literature meet with the requirement of tender specification. Only when the samples are approved in writing by the SBI /Architect the contractor shall proceed with the procurement and installation of the particular material/equipment.

The approved samples shall be signed by the SBI /Architect for identification and shall be kept on record at site office until the completion of the work for inspection/comparison at any time. The SBI/Architect shall take reasonable time to approve the sample. Any delay that might occur in approving the samples for reasons of its not meeting the specifications or other discrepancies inadequacy in furnishing samples of best qualities from various manufacturers and such other aspects causing delay on the approval of the materials/equipment etc. shall be to the account of the contractor.

(iii) Cost of tests: The cost of making any test shall be borne by the contractor if such test is intended by or provided for in the specifications or BOQ.

(iv) Cost of test not provided for: If any test is ordered by the SBI/Architect which is either:

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

16.0 Obtaining Information related to execution of work: No claim by the contractor for additional payment shall be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting the execution of the work nor any misunderstanding or the obtaining incorrect information or the failure to obtain correct information relieve him from any risks or from the entire responsibility for the fulfilment of contract.

17.0 Contractor's superintendence: The contractor shall give necessary personal superintendence during the execution of the works and as long, thereafter, as the SBI/Architect may consider necessary until the expiry of the defect liability period, stated hereto.

18.0 Quantities: i) The bill of quantities (BOQ) unless or otherwise stated shall be deemed to have been prepared in accordance with the Indian Standard Method of Measurements

The rate quoted shall remain valid for variation of quantity against individual item to any extent subject to maximum variation of the contract value by 25%. The entire amount paid under Clause 20 hereof as well as amounts of prime cost and provisional sums, if any, shall be excluded.

ii) Variation exceeding 25%: The items of work executed in relation to variation exceeding 25% shall be paid on the basis of provisions of clause 21(e) hereof. Rate of this item will not exceed the tender rate.

19.0 Works to be measured: The SBI/Architect may from time to time intimate to the contractor that he required the work to be measured and the contractor shall forthwith attend or send a qualified representative to assist the SBI/Architect in taking such measurements and calculation and to furnish all particulars or to give all assistance required by any of them. Such measurements shall be taken in accordance with the Mode of measurements detailed in the specifications. The representative of the SBI/ Architect shall take joint measurements with the contractor's representative and the measurements shall be entered in the measurement book.

The contractor or his authorized representative shall sign all the pages of the measurement book in which the measurements have been recorded in token of his acceptance. All the corrections shall be duly attested by both representatives. No writings shall be made in the measurement book. Should the contractor not attend or neglect or omit to depute his representative to take measurements then the measurements recorded by the representative of the SBI/ Architect shall be final. All authorized extra work, omissions and all variations made shall be included in such measurements.

20.0 Variations: No alteration, omission or variation ordered in writing by the SBI/Architect shall vitiate the contract.

In case the SBI /SBI/Architect thinks proper at any time during the progress of works to make any alteration in, or additions to or omission from the works or any alteration in the kind or quality of the materials to be used therein, the Architect/Consultant shall give notice thereof in writing to the contractor or shall confirm in writing within seven days of giving such oral instructions the contractor shall alter to, add to, or omit from as the case may be in accordance with such notice but the contractor shall not do any work extra to or make any alteration or additions to or omissions from the works or any deviation from any of the provisions of the contract, stipulations, specifications or contract drawings without previous consent in writing of the Architect/Consultant and the value of such extras, alterations, additions or omissions shall in all cases be determined by the Architect/Consultant and the same shall be added to or deducted from the contract value, as the case may be.

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

a. The net rates or prices in the contract shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced herein. Rates for all items, wherever possible should be derived out of the rates given in the priced BOQ.

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

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

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

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

22.0 Final Measurement: The measurement and valuation in respect of the contract shall be completed within **one month** of the virtual completion of the work.

23.0 Virtual Completion Certificate (VCC): On successful completion of entire works covered by the contract to the full satisfaction of the SBI, the contractor shall ensure that the following works have been completed to the satisfaction of the SBI-

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

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

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

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

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

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

Upon the satisfactory fulfilment by the contractor as stated above, the contractor shall be entitled to apply to the Architect/Consultant for the certificate. If the SBI/Architect/Consultant is satisfied of the completion of the work, relative to which the

completion certificate has been sought, the SBI/Architect/Consultant shall within fourteen (14) days of the receipt of the application for virtual completion certificate, issue a VCC in respect of the work for which the VCC has been applied.

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

23A. Defects after Completion:

The contractor shall make good at his own cost and to the satisfaction of the employer all defects, shrinkages, settlement or other faults which may appear **within 12 months** after virtual completion of work. In default, the employer may employ and pay other persons to amend and make such damages, losses and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damages, loss and expenses shall be recoverable from him by the employer or may be deducted by the employer in lieu of such amending and making good by the contractor deduct from any money due to the contractor a sum of equivalent to the cost of amending such work and in the event of the amount retained being insufficient, recover that balance from the contractor from the amount retained under relevant clause together with any expenses the employer may have incurred in connection therewith.

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

25.0 Insurance of Works

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

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

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

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

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

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

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

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

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

25.3 Contractor to indemnify SBI: The contractor shall indemnify the SBI against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the provision sub-clause 25.2 of this clause.

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

The contractor shall employ at least the following technical staff besides other personal: One graduate engineer / Senior Diploma holder having experience of 5yrs or more. The above technical staff should be available at site to take instructions whenever required by

the architect/employer. In case the contractor fails to comply the technical staff as aforesaid he shall be liable to pay a sum of RS. 5000 each month or part thereof for default. The decision of architect/employer so as to the period will be final and binding on the contract.

25.5 Third-Party Insurance

25.5.1 Before commencing the execution of the work the contractor but without limiting his obligations and responsibilities under clause 25 of GCC shall insure against his liability for any material or physical damage, loss, or injury which may occur to any property including that of SBI, or to any person, including any employee of the SBI, by or arising out of the execution of the works or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to clause 25 thereof.

25.5.2 Minimum Amount of Third-Party Insurance: Such insurance shall be affected with an insurer and in terms approved by the SBI which approval shall not be reasonably withheld and for at least the amount stated below. The contractor shall, whenever required, produce to the SBI/Architect the policy or policies of insurance cover and receipts for payment of the current premiums.

The minimum insurance cover for physical property, injury, and death is Rs.5.0 lacs per occurrence with the number of occurrences limited to four. After each occurrence contractor will pay the additional premium necessary to make insurance valid for four occurrences always.

25.7 Accident or Injury to Workmen

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

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

25.7.3 Remedy on Contractor's failure to insure: If the contractor fails to effect and keep in force the insurance referred to above or any other insurance which he may be required to effect under the terms of contract, then and in any such case the SBI may effect and keep in force any such insurance and pay such premium or premiums as may be neces-

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sary for that purpose and from time to time deduct the amount so paid by the SBI as aforesaid and also deduct 15% of contract value from any amount due or which may become due to the contractor, or recover the same as debt from the contractor.

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

26.0 Commencement of Works: The date of commencement of the work will be reckoned as the recorded date of handing over site by the SBI/SBI or **14 days** from the date of receipt of Letter of Acceptance from SBI, whichever is later.

27.0 Time for completion: Time is the essence of the contract and shall be strictly observed by the contractor. The entire work shall be completed within a period of **Eight Calendar month** from the date of commencement. If required in the contract or as directed by the SBI/Architect, the contractor shall complete certain portions of work before completion of the entire work. However, the completion date shall be reckoned as the date by which the whole work is completed as per the terms of the contract.

28.0 Extension of Time: If, in the opinion of the Architect/Consultant, the work be delayed for reasons beyond the control of the contractor, the Architect/Consultant may submit a recommendation to the SBI to grant a fair and reasonable extension of time for completion of work as per the terms of contract. If the contractor needs an extension of time for the completion of work or if the completion of work is likely to be delayed for any reasons beyond the due date of completion as stipulated in the contract, the contractor shall apply to the SBI through the Architect/Consultant in writing at least 15 days before the expiry of the scheduled time and while applying for extension of time he shall furnish the reasons in detail and his justification if any, for the delays. The architect/consultant shall submit their recommendations to the SBI in the prescribed format for granting extension of time. While granting extension of time the contractor shall be informed the period extended time which will qualify for levy of liquidated damages. For the balance period in excess of original stipulated period and duly sanctioned extension of time by the SBI the provision of liquidated damages as stated under clause 8 of GCC shall become applicable. Further contract shall remain in force even for the period beyond the due date of completion irrespective whether the extension is granted or not.

29.0 Rate of progress: Whole of the materials, plant and labour to be provided by the contractor and the mode, manner and speed of execution and maintenance of the works are to be of a kind and conducted in a manner to the satisfaction of the SBI/Architect. Should the rate of progress of the work or any part thereof be at any time be in the opinion of the SBI /Architect too slow to ensure the completion of the whole of the work by the prescribed time or extended time for completion the SBI /Architect shall thereupon take

such steps as considered necessary to expedite progress so as to complete the works by the prescribed time or extended time. Such communications from the SBI /Architect neither shall relieve the contractor from fulfilling obligations under the contract nor he shall be entitled to raise any claims arising out of such directions.

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

All work at night after obtaining approval from competent authorities shall be carried out without unreasonable noise and disturbance so as to avoid disputes with the neighbours.

31.0 No compensation for restrictions of work: If at any time after acceptance of the tender SBI shall decide to abandon or reduce the scope of work for any reason whatsoever and hence not require the whole or any part of the work to be carried out, the SBI Architect shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the work fully but which he did not derive in consequence of the foreclosure of the whole or part of the work. Provided that the contractor shall be paid the charges on the cartage only of materials actually and bona fide brought to the site of the work by the contractor and rendered surplus as a result of the abandonment, curtailment of the work or any portion thereof and then taken back by the contractor, provided however that the SBI /Architect shall have in such cases the option of taking over all or any such materials at their purchase price or a local current rate whichever is less. In case of such stores having been issued from SBI stores and returned by the contractor to stores, credit shall be given to him at the rates not exceeding those at which were originally issued to the contractor after taking into consideration and deduction for claims on account of any deterioration or damage while in the custody of the contractor and in this respect the decision of SBI /SBI/Architect shall be final.

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

- a) On account of any default on the part of the contractor, or
- b) For proper execution of the works or part thereof for reasons other than the default of the contractor, or
- c) For the safety of the works or part thereof.

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The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the SBI /SBI/Architect.

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

The contractor shall be entitled to an extension of time equal to the period of every such suspension. No compensation whatsoever shall be paid on this account.

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

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

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

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

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

34.0 Owner's Right to Terminate the Contract: If the contractor being an individual or a firm commit any 'Act of Insolvency' or shall be adjusted an insolvent or being an incorporated company shall have an order for compulsory winding up voluntarily or subject to the

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supervision of Government and of the Official Assignee of the liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him to do so, to show to the reasonable satisfaction of the SBI /Architect that he is able to carry out and fulfil the contract, and to give security therefore if so required by the SBI.

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

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

a) Has abandoned the contract; or

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

c) Has failed to proceed with the works with such diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or has failed to remove the materials from the site or to pull down and replace work within seven days after written notice from the SBI through the Architect/ Consultant that the said materials were condemned and rejected by the Architect/ Consultant under these conditions; or has neglected or failed persistently to observe and perform all or any of the acts, matters or things by this contract to be observed and performed by the contractor for seven days after written notice shall have been given to the contractor to observe or perform the same or has to the detriment of good workmanship or in defiance of the SBI /SBI's or Architect's/Consultant's instructions to the contrary subject any part of the contract. Then and in any of said cases the SBI and or the Architect/Consultant, may not withstanding any previous waiver, after giving seven days' notice in writing to the contractor, determine the contract, but without thereby affecting the powers of the SBI or the Architect/Consultant or the obligation and liabilities of the contractor the whole of which shall continue in force as fully as if the contract had not been so determined and as if the works subsequently had been executed by or on behalf of the contractor. And, further the SBI through the Architect/Consultant, their agents or employees may enter upon and take possession of the work and all plants, tools, scaffoldings, materials, sheds, machineries lying upon the premises or on the adjoining lands or roads, use the same by means of their own employees or workmen in carrying on and completing the work or by engaging any other contractors or persons to complete the work and the contractor shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other contractor or other persons employed for completing and finishing or using the materials and plant for the works. When the works shall be completed or as soon thereafter as convenient to the SBI or the Architect/Consultant shall give a notice in writing to the contractor to remove his surplus materials and plants and should the contractor fail to do so within 14 days after receipt thereof by him the SBI. /SBI sell the same by public auction after due publication and shall adjust the amount realized by such auction. The contractor shall have no right to question any of the acts of the SBI incidental to the sale of the materials etc.

35.0 Certificate of Payment:

Certificate of Payment: Payment will be made as per terms mentioned in the NIT.

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

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

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

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

The SBI shall modify the certificate of payment as issued by the Architect/Consultant from time to time while making the payment.

The contractor shall submit interim bills only after taking actual measurements and properly recorded in the Measurement book (M.B).

The contractor shall not submit interim bills when the approximate value of work done by him is less than the amount as mentioned in NIT and the minimum interval between two such bills shall be one month, subject to satisfaction of Bank.

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

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

35.1. Certification of bills & payments

Normally the agreement stipulates the value of works for interim bills. When the gross payment due to the contractor against work done including secured advance against the value of materials collected at site exceeds the amount of interim amount of bill specified in the tender, the contractor is entitled to submit a bill as explained below:

- i) The contractor shall prepare the bill (Refer Annexure-18) in triplicate on the basis of the item wise abstract of the total measured quantities as recorded in the MBs. The tender items shall be serially reproduced in the bill. The extra or variation items which have been approved shall only be included in the bill. Such extra items shall be shown in the bill in separate sub-head along with references for approvals. The bills in triplicate shall be submitted to the Bank's Site Engineer/Architect.

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- ii) The Bank's Site Engineer/Architect on receipt of the bill in triplicate from the contractors shall verify the following:
 - a) The bill of quantities is as per the measurements recorded in the MBs.
 - b) The rates for different items are as per accepted tender/quotation and/or the approved rates for variation.
 - c) The part rates are commensurate with the actual stage of work done, and reasons for allowing part rates are briefly mentioned.
 - d) Quantities of materials for which secured advance has been claimed have actually been collected at site and necessary undertaking as per prescribed proforma (Refer Annexure-14 & 15) is furnished by the contractor.
 - e) Rates allowed for advance against materials brought to site are based on the admitted percentage as provided in the contract or invoice amount or pro-rata amount for such material relating to the respective tender item rate, whichever is lower.
 - f) Deductions/rebate on account of retention money, mobilization advance, or any item of work have correctly been shown in the bill.
 - g) Proper insurance cover as provided for in the contract and for proper value has been taken by the contractor.
 - h) Test certificates for the materials used, concrete etc. required as per the contract have been enclosed.
- iii) The bill after due verification as above and after incorporating necessary corrections shall be certified by the Site Engineer/Architect. The bill in triplicate shall then be sent to the architects for certification, who will also give a statement for the following:
 - a) Statement giving reasons for excessive variations i.e. above 20% in the quantities as compared to the tender quantities.
 - b) Statements showing the theoretical and actual consumption of cement and steel.
- iv) The bill shall be thoroughly scrutinized and checked by the architects and sent to the Premises/ Estate Department along with a certificate of payment in duplicate as per Annexure-13. The architects shall satisfy about compliance of all requirements as per the terms of contract. Necessary test check measurements shall be done by the Bank Engineer.

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- v) Where tender provides for adhoc payment of R.A. bills, adhoc payment shall be made by the Bank after due certification by the Architects after observing the following formalities:
- a) A certificate for adhoc payment representing the percentage mentioned in the contract of the net amount payable shall be obtained from the architects.
 - b) The Premises Department shall exercise a preliminary check on the bill including recovery statement for any materials supplied, and all other recoveries to be made from the bill as per agreement.
 - c) It shall be ensured that the payment of bills including adhoc payments are made within the time stipulated in the contract.
- vi) The bill along with measurement books duly certified by the architects received in the Premises & Estate Departments shall be processed for payment on priority basis:
- a) The Concerned Engineer shall carry out arithmetical check of the bill in addition to complete verification of all relevant facts in regard to both tendered and non-tendered items, rates, advances, recoveries, rebates, insurance cover, and validity of Bank Guarantees etc. After satisfying himself about the correctness of the bill, he has to prepare Memorandum of payment.
 - b) He shall also ensure that (1) only approved extra/variation items are considered in the bill, (2) necessary certificates are recorded and (3) necessary test check measurements are done by the architects and Bank's Engineer.
 - c) The payment shall thereafter be released after taking into account the adhoc payment made, if any. After the bill is passed for payment, the contractor shall be advised of the details like gross amount of the bills paid so far, gross amount of particular bill passed along with details of recoveries.
 - d) While passing a bill for payment, if the gross amount of the bill exceeds the sanctioned cost including the contingencies, the payment shall be restricted to the sanctioned amount and after obtaining the additional sanction from the earlier sanctioned authority the balance amount may be released.
- vii) In terms of the relevant provision of the Income Tax Act 1961, all payments made against the bills shall be subject to the recovery of income Tax and surcharge as specified by the I.T. Department. The amount so deducted shall be credited to the Government account and a certificate of deductions

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shall be given to the contractor. All statutory recoveries including labour cess etc. are affected from the gross values of the bill.

- viii) The Architect shall ensure that the final bills are obtained from the contractors as early as possible after the virtual completion certificate with a view to settle the bill within the stipulated period of three months/contractual conditions.
- ix) While scrutinizing the final bill, the following checks shall be exercised:
- a) That the architects have issued the virtual completion certificate for the work.
 - b) That extension of time, if any, beyond scheduled date of completion has been granted by the competent authority.
 - c) That where the invocation of Liquidity damages clause has been decided upon, the recovery of liquidated damages has been affected.
 - d) That the contractors have submitted the necessary guarantees/undertakings/test certificates as required in terms of contract.
 - e) That all advances including mobilization advance are recovered in full. The interest component as applicable shall also be recovered.
 - f) That there are no outstanding recoveries against the contractors on account of water, electricity, telephone charges or damages to fittings/fixtures or any other account as specifically provided for in the agreement.
 - g) That all receipt for refundable deposits, if any, paid by the contractors on behalf of the Bank, have been submitted by the contractor to the Bank, so that the Bank may pursue with the concerned authorities, for obtaining refund of the same.
 - h) That the required check measurements have been carried out in the MBs and the fact recorded in the MB.
 - i) That the contractors have been given a certificate to the effect that "Accepted in full and final settlement of all claims".
 - j) Income Tax, Sales tax on works contract, Labour cess or any other tax as per terms of contract are recovered as per the statutory regulations.
 - k) That the total cost of work is within the sanction, If not, revised sanction has to be obtained before releasing the payment to the contractor.
 - l) Two sets of executed plans.

36.0 Settlement of Disputes and Arbitration:

Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the work or the execution or failure to execute the same, whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter :

- i) If the contractor considers that he is entitled to any extra payment or compensation in respect of the works over and above the amounts admitted as payable by the Architect or in case the contractor wants to dispute the validity of any deductions or recoveries made or proposed to be made from the contract or raise any dispute, the Contractor shall forthwith give notice in writing of his claim, or dispute to the Assistant General Manager (Premises& Estate)/Dy. General Manager (Premises) and endorse a copy of the same to the Architect, within 30 days from the date of disallowance thereof or the date of deduction or recovery. The said notice shall give full particulars of the claim, grounds on which it is based and detailed calculations of the amount claimed and the contractor shall not be entitled to raise any claim nor shall the Bank be in any way liable in respect of any claim by the contractor unless notice of such claim shall have been given by the contractor to the Assistant General Manager (Premises& Estate)/Dy. General Manager (premises) in the manner and within the time as aforesaid. The contractor shall be deemed to have waived and extinguished all his rights in respect of any claim not notified to the Assistant General Manager (Premises & Estate) / Dy. General Manager (Premises) in writing in the manner and within the time aforesaid.
- ii) The Assistant General Manager (Premises & Estate) / Dy. General Manager (Premises) shall give his decision in writing on the claims notified by the contractor. The contractor may within 30 days of the receipt of the decision of the Assistant General Manager (Premises& Estate) / Dy. General Manager (Premises) submit his claims to the conciliating authority namely the Circle Development Officer/General Manager (Official Language & Corporate Services) for conciliation along with all details and copies of correspondence exchanged between him and the Assistant General Manager (Premises& Estate)/Dy. General Manager (Premises)
- iii) If the conciliation proceedings are terminated without settlement of the disputes, the contractor shall, within a period of 30 days of termination thereof shall give a notice to the concerned Chief General Manager/Dy. Managing Director (HR) & Corporate Development Officer of the Bank for appointment of an arbitrator to adjudicate the notified claims failing which the claims of the contractor shall be deemed to have been considered absolutely barred and waived.
- iv) Except where the decision has become final, binding and conclusive in terms of the contract, all disputes or differences arising out of the notified claims of the contractor as aforesaid and all claims of the Bank shall be referred for adjudication through arbitration by the Sole Arbitrator appointed by the Chief General Manager at LHO /Dy. Managing Director & Corporate Development Officer at CC/CCEs. It will also be no objection to any such appointment that the Arbitrator so appointed is a technically competent person not below the rank of Superintending Engineer or equivalent position in Public Sector Banks / CPSEs, CPWD, LIC, RBI etc. If the arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another sole arbitrator shall be appointed in the manner aforesaid by the said Chief General Manager/

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Dy. Managing Director (HR) & Corporate Development Officer. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

- v) It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each dispute along with the notice for appointment of arbitrator.
- vi) It is also a term of this contract that no person other than a person appointed by such Chief General Manager aforesaid should act as arbitrator.
- vii) The conciliation and arbitration shall be conducted in accordance with the provisions of the Arbitration & Conciliation Act 1996 or any statutory modification or re-enactment thereof and the rules made there under. viii) It is also a term of the contract that if any fees are payable to the arbitrator these shall be paid equally by both the parties.
- ix) It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims. The venue of the arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The fees if any, of the arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award (including the fees, if any of the arbitrator) shall be in the discretion of the arbitrator who may direct to any by whom and in what manner, such costs or any part thereof shall be paid and fix or settle the amount of costs to be so paid.

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

- i. That the water used of the contractor shall be fit for construction/renovation purposes to the satisfaction of the SBI/Architect.
- ii. The contractor shall make alternative arrangements for the supply of water if the arrangement made by the contractor for procurement of water in the opinion of the Architect / Consultant is unsatisfactory. If the contractor uses water from the source of the employer, **recover @0.5%** of the bill for water charge shall be affected from the running bill of the contractor from time to time.

37.1. The contractor shall construct temporary well / tube well in SBI land for taking water for construction purposes only after obtaining permission in writing from the SBI. The contractor has to make his own arrangements for drawing and distributing the water at his own cost. He has to make the necessary arrangements. To avoid any accidents or damages caused due to construction/renovation and subsequent maintenance of the wells. He has to obtain necessary approvals from local authorities, if required, at his own cost. He shall restore the ground to its original condition after wells are dismantled on completion of work or hand over the well to the SBI without any compensation as directed by the Architect / Consultant.

38.0 Power supply: The contractor shall make his own arrangements for power and supply/distribution system for driving plant or machinery for the work and for lighting purpose at his own cost. The cost of running and maintenance of the plants are to be included in his tender prices. He shall pay all fees and charges required for the power supply and include the same in his tendered rates and hold the owner free from all such costs. He has to obtain necessary approvals from the appropriate authorities, if required. If the contractor uses electrical power from the source of the employer, **recover 0.5%** of the bill

for electricity consumption shall be affected from the running bill of the contractor from time to time.

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

40.0 Method of Measurement: Unless otherwise mentioned in the schedule of quantities or in mode of measurement, the measurement will be on the net quantities or work produced in accordance with up to date. Rules laid down by the Bureau of Indian standards. Measurement shall be as per units of measurement in specification. IS 1200 may be followed if there is any discrepancy. **For steel**, it shall be measured in weight in kg and no allowance is made in the weight for rolling margin. Wastage, binding wires shall not be measured. Authorized overlap, spacers, chairs shall only be measured.

Both cement and steel consumption statement shall be submitted along with bill. Coefficient for Cement consumption shall be as per CPWD. In the event any dispute/disagreement the decision of the Architect/Consultant shall be final and binding on the contractor

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

42.0 PRICE VARIATION ADJUSTMENT (PVA) FOR ALL MATERIALS (INCLUDING CEMENT & STEEL) & LABOUR

(i) **NOT APPLICABLE FOR THIS PROJECT**

43.0 Force Majeure:

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

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

43.3 From the date of occurrence of a case of force majeure obligations of the party affected shall be suspended during the continuance of any inability so caused. With the cause itself and inability resulting there from having been removed, the agreed time of

completion of the respective obligations under this agreement shall stand extended by a period equal to the period of delay occasioned by such events.

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

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

- i) Minimum Wages Act, 1948 (Amended)
- ii) Payment of Wages Act 1936 (Amended)
- iii) Workmen's Compensation Act 1923 (Amended)
- iv) Contract Labour Regulation and Abolition Act 1970 and Central Rules 1971(Amended)
- v) Apprentice Act 1961 (Amended)
- vi) Industrial Employment (Standing Order) Act 1946 (Amended)
- vii) Personal Injuries (Compensation Insurance) Act 1963 and any other modifications
- viii) Employees' Provident Fund and Miscellaneous Provisions Act 1952 and amendment thereof
- ix) Shop and Establishment Act
- ix) Any other Act or enactment relating thereto, and rules framed there under from time to time.

45.0 SAFETY CODE & MEASURES AT SITE:

1. All personnel at site should be provided with Helmets and Safety Boots with some Identification Mark. Visitors also should be provided with Helmets. It should be ensured that these are used properly.
2. First Aid Box should be kept at site with all requisite materials.
3. No one should be allowed to inspect / work at a height without Safety Belt.
4. Suitable scaffolds should be provided for workmen for all Works that cannot safely be done from the ground, or from solid construction/renovation except such short period Work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well as suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical).
5. Scaffolding or staging more than 3.5 meters above the ground or floors, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least

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1 Meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

6. Working platforms, Gangways, and Stairways should be so constructed that they do not sag unduly or unequally, and if the height of the platform or the Gangway or the Stairway is more than 3-5 Meters above ground level or floor level they should be closely boarded, should have adequate width and should be suitably fenced, as described.
7. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 Meter.
8. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 Meters in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including Meters in length. For longer ladders this width should be increased at least 6mm for each additional 30 CMS. Uniform step spacing shall not exceed 30 CMS.
9. Adequate precautions shall be taken to prevent danger from electrical equipment. For electrical on line works gloves, rubber mats, and rubber shoes shall be used.
10. All trenches 1.2 Meters or more in depth shall at all times be supplied with at least one ladder for each 30 Meters length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1 Meter above the surface of the ground. The sides of the trenches, which are 1.5 Meters or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 Meters of the edge of the trench or half of the depth of the trench whichever is more cuttings shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.
11. Before any demolition work is commenced and also during the process of the work: -
 - a) All roads and open areas adjacent to the Work Site shall either be closed or suitably protected;
 - b) No electrical cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.
 - c) All practical steps shall be taken to prevent danger to persons employed from risk or fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.
 - d) All necessary personal safety equipment as considered adequate by the Site Engineer should be kept available for the use of the persons employed on the Site and maintained in a condition suitable for immediate use; and the Contractor should take adequate steps to ensure proper use of equipment by those concerned.
 - e) Workers employed on mixing Asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - f) Those engaged in white washing and mixing or stacking of cement bags or any materials which is injurious to the eyes shall be provided with protective goggles.

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

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

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

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

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

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

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

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

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

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

g) When workers are employed on electrical installation, which is already energized, insulating mats, wearing apparel such as gloves, rubber footwear etc.

46.0 Accidents: The contractor shall immediately on the occurrence of any accident at or about the site or in connection with the execution of the work report such accident to the Architect/Consultant. The contractor shall also report immediately to the competent

authority whenever such report is required to be lodged by the law and take appropriate actions thereof.

47. Integrity Pact

a) The pact essentially envisages an agreement between the prospective vendors/bidders and the buyer, committing the persons/officials of both sides, not to resort to any corrupt practices in any aspect/stage of the contract. Only those vendors/bidders, who commit themselves to such a Pact with the buyer, would be considered competent to participate in the bidding process. In other words, entering into this Pact would be a preliminary qualification. The essential ingredients of the Pact include:

- a) Promise on the part of the principal not to seek or accept any benefit, which is not legally available;
- b) Principal to treat all bidders with equity and reason;
- c) Promise on the part of bidders not to offer any benefit to the employees of the Principal not available legally;
- d) Bidders not to enter into any undisclosed agreement or understanding with other bidders with respect to prices, specifications, certifications, subsidiary contracts, etc.
- e) Bidders not to pass any information provided by Principal as part of business relationship to others and not to commit any offence under PC/ IPC Act;
- f) Foreign bidders to disclose the name and address of agents and representatives in India and Indian Bidders to disclose their foreign principals or associates;
- g) Bidders to disclose the payments to be made by them to agents / brokers or any other intermediary.
- h) Bidders to disclose any transgressions with any other company that may impinge on the anti-corruption principle.

Integrity Pact, in respect of a particular contract, would be operative from the stage of invitation of bids till the final completion of the contract. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

48. Assignment Subletting: The whole of the works included in the contract shall be executed by the composite contractor and the same shall not directly or indirectly transfer, assign or underlet therein without the written permission of the bank and no undertaking shall relieve the contractor from any liability or obligation under the contract. No subletting of the work is permitted.

48. BANK'S BUILDING PROJECTS-MAINTENANCE OF RECORDS AT SITE OFFICE

| A. | Registers at the site office |
|-----------|--|
| 1 | Measurement Books. |
| 2 | Cement Register (Daily Record). |
| 3 | Steel Register. |
| 4 | Steel Consumption Register – Bill wise. |
| 5 | Drawings register |
| 6 | Materials at site register. |
| 7 | Hindrance Register. |
| 8 | Concrete cube Test Register. |
| 9 | File and Register for extra / variation items. |
| 10 | Materials test Register and File. |
| 11 | Site Order Book (in triplicate). |
| 12 | Lead caulking Register. |
| 13 | Labour Reports and progress Reports Register. |
| 14 | Site Visit & Instructions Register. |
| 15 | Certified true copies of the contracts. |
| 16 | Format for Bar Bending Schedule (BBS) |

SPECIAL CONDITIONS OF THE CONTRACT (SCC)

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SPECIAL CONDITIONS OF THE CONTRACT (SCC)

01. **INSPECTION OF DRAWINGS**

SPCC-01

Before filing in the tender, the tenderer will have to check up all Drawings and Schedules of quantities and will have to get an immediate clarification from the Architect/ Consultant on any point that he feels is vague or uncertain. No claim for damages or compensation will be entertained on this account.

02. **EXECUTION OF WORK**

SPCC-02

The whole of the work as described in the Contract (including the schedule of quantities the specifications and all drawing pertaining hereto) and as advised by the Architect/ Consultant from time to time is to be carried out and completed in all its parts to the entire satisfaction of the Employer/ Architect/ Consultant. Any minor details of work which are obviously and fairly attended, or which may not have been definitely referred to in this contract, but which are usual in sound construction practice and essential to the work, are to be included in that contract. Rates quoted in the Schedules shall be inclusive of all freights, taxes, duties such as Vat, Octroi, Sales Tax, Work Contract Tax, Excise Duty, Royalties etc., as well as transportation to as to execute the contract as per the rules and regulations of Local Bodies. State Government and the Government of India and to the full intent of tender document.

Following shall be deemed to be provided for in the quoted rates.

- 02a Labour, maintenance, flying, carrying, cleaning, making good, hauling, wastage etc.
- 02b Plant, double scaffolding frame work, English ladders, ropes, nails, spikes, tools, material and workmanlike-protection from weather, shuttering, temporary supports, plant for and the maintenance of the same.
- 02c Covering for the walling and other works during inclement weather or strikes or whenever directed as necessary.
- 02d All temporary canvas, lights, tarpaulin, barricades, water sheets etc.
- 02e All stairs and steps thresholds and any other requisite protection of the works.
- 02f All such temporary weather-proof sheds at such places and in a manner approved by the Architect/ Consultant for the storage and protection of materials against the effects of Sun or Rain.
- 02g All such temporary fences guards approaches and roads say be necessary for execution of the contract works and for safeguarding the public.
- 02h The necessary scaffolding, labour and removal of the same after the completion of the work. The Architect/ Consultant will be sole judge in deciding as to the suitability of the tools and plant that say be brought at the works by the Contractors for the proper execution of the work.

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The rates quoted by the tenderer in the schedule of probable quantities will be deemed to be for the finished work inclusive of the list of providing the above items

03. **ITEMS NOT COVERED** **SPCC-03**
- a) If any item of work is ordered to execute which is not covered in the contract it will be paid for through deriving from analogous item of the contract and if such item is not available then as per valuation that would be derived on the basis of the actual cost of the materials and labour incurred in carrying out the said work, as specified and directed by Employer/ Architect and as determined by the Employer, plus 15% (Fifteen percent) to allow for Contractor's profit and overhead and other related costs.
- b) Any work not carried out as per drawings issued for Execution and Specification and/ or instructions or is defective in the opinion of the Employer/Architect shall be demolished and replaced by new work by the Contractor to the satisfaction of the Architect and/ or Consulting Engineer. If the Architect may allow such work to remain the Contractor shall accept a reduction in the rate quoted by him and/ or reduction in the total cost of such works as will be assessed and decided upon by the Architect. Employers' decision on recommendation of Architect/Bank shall be final and binding to the Contractor.
- c) Substitution/ Variation/ Deviations: Should the Contractor desire to substitute any materials and workmanship, he/ they must obtain the approval of the Employer/ Architects in writing for any such substitution well in advance. Materials designated in this specification indefinitely by such term as "Equal" or "Other Approved" etc. specific approval of the Employer/ Architects has to be obtained in writing.
The price of all such additional items/ non-tendered items will be worked out on the basis of rates quotes for similar items in the contract wherever existing or on engineering rate analysis based on prevalent fair price of labour, material and other component as required.
04. **ACCESS FOR INSPECTION** **SPCC-04**
- The Contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, ladders, gang ways etc., and the necessary attendants to move and adapt the same as directed for the inspection or measurement of the works by the Architect/ Consultant/Employer or their representatives.
05. **DIMENSION** **SPCC-05**
- Figured dimensions are in all cases to be followed and no case should they be scaled? Large scale details kike precedence over small scale drawings. In case of discrepancy, the Contractor is to ask for an explanation before proceeding with the work.
06. **PROGRAMME OF WORK** **SPCC-06**
- The Bidder shall, along with his bid, submit completion of work, either in the form of CPM Net Work or in the form of a bar chart, showing how he proposes to complete the works. This programme shall be prepared in suffi-

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cient detail and shall – indicate, among other things, the following details on month-to-month basis (for each month) or week to week.

- 06a Quantum of work under each major item of work that should be carried out.
- 06b Amount of resources that would be deployed e.g. skilled/ unskilled labour carpenter's equipment etc.
- 06c Schedule of delivery of materials to site.
- 06d Approximate value of work contemplated to be completed each month/week.
- 06d Schedule and manner in which detail is or material (to be issued by the – Employer) are required from the Architect/Consultant/Employer.
- 06e Time period allowed for other agencies work.
- 06f Various milestones to be achieved.

This program, suitably amended after discussions with the Architect/ Consultant/Employer, shall become binding on the, Contractor. However, during the execution of project, should it become necessary in the opinion of the Architect/Consultant/Employer to reschedule some of the activities the Contractor shall do so at no extra cost and/or without any other claim.

Acceptance of bidder's tender does not necessarily, imply acceptance of the schedule submitted and the Architect/Consultant/Employer reserves to himself the right to modify/amend this schedule to suit the overall project schedule and the Contractor shall adhere to these revisions/modifications at no extra cost to the Employer.

Open space for storage could be provided by the Employer. The Contractor has to make arrangements for enclosing open space for providing safety Arrangements.

- 07. WORK ON HOLIDAY/WEEK DAYS **SPCC-07**
Major work is required to be carried out after office hours and holidays without disturbing the departments/occupants in the building / floor and during office hours on working days may be permitted provided care is taken by the Contractor for not causing any disturbance to the working staff.
- 08. ACTION WHERE THERE IS NO SPECIFICATION **SPCC-08**
In the case of any class of work over which there is no specification mentioned, the same shall be carried out in accordance with the Indian Standard Specifications subject to the approval of the Architect/ Consultant and clients.
- 09. REPORTING OF ACCIDENT TO LABOUR **SPCC-09**
Contractor shall be responsible for the safety of persons employed by him on the works and shall report accidents to any of them, however and wherever occurring on the works, to the Architect/ Consultant/Employer. The Contractor

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shall make every arrangement to render all possible service to such workman. This shall be without prejudice to the responsibility of the Contractor to under the Insurance Clause of the General Condition.

10. **KEEPING THE SITE CLEAN & CLEAR** **SPCC-10**
During the progress of the works and when directed by the Architect/ Project Management Consultant the Contractor shall keep the site clear of all rubbish and debris including that which may be deposited on the site by any Sub- Contractors and shall maintain the housekeeping at site premises by properly stacking different materials on different locations/ yards until the date of issue of Certificate of Completion. The contractor at his own cost shall develop separate yards for Materials. All scraped materials shall be dumped in the scrap yard specially designated in the site premises for this purpose. The cost of keeping the site clean shall be deemed to have been included for in the rates.
On completion of the works, the Contractor shall at his own expense clear away and remove from the site not later than 7 (seven) days from the date of Completion of works all constructional plant, surplus material, rubbish and temporary works of every kind as required by local statutory authorities if applicable, and leave the entire site and works clean and in a workman like condition. In case of failure by the Contractor, the Employer under the advice of Architect/ Project Management Consultant will have the right to get the site cleared at the risk and cost of the Contractor to the satisfaction of the Architect/ Employer.
11. **OCCUPATION OF PARTIALLY COMPLETED BUILDING BY THE EMPLOYER** **SPCC-11**
The Employer shall be entitled to and at liberty to occupy even the partially completed premises or any portion thereof by themselves or through their agents and servants if they so desire in which even. Necessary extension of time & on this account for completing the work shall however, be granted to the Contractor, but he shall have no claim for any compensation whatsoever due to the delay involved in completing the work.
12. **PREPARATION OF BUILDING FOR OCCUPATION AND USE ON COMPLETION** **SPCC-12**
On completion of the work, the Contractor shall inform the Architect/ Consultant in writing that he has finished the work and it is ready for the Architect/ Consultants inspection. The Contractor/Employer shall clean all windows and doors including the cleaning and oiling if necessary of all hardware, inside and outside, all floors, staircase and every part of the building. He will leave the entire building neat and clean and ready for occupation and to the satisfaction of the Architect/ Consultant.
13. **WAGES OF LABOUR EMPLOYED BY THE CONTRACTOR** **SPCC-13**
The Contractor shall pay all labour employed by him at rates fixed by him at the commencement of the Contract as per the Labour Laws. Wages as applicable for the construction work as per norms stipulated by the Bombay Metro Corporation/ Labour Laws / Local Bodies etc. shall be followed by the Contractor.

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No variation of such statutory laws & rules shall be permissible. This will also include the minimum & maximum allowable wages for various categories of labour to be employed by the Contractor

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

14. EXTRA ITEMS / DEVIATIONS

SPCC-14

The Contractor shall not commence work in respect of any extra items/deviations without obtaining the approval of the Architect/Consultant/Employer in writing. The Contractor shall immediately submit the rate analysis for such items, with necessary details to support the rate quoted. The rate shall then be settled by the Architect/ Consultant and necessary certificate based on this shall be given to the Employer while incorporating the item in the Interim Bills.

Claim for extra/ deviated items shall be submitted in the yellow/pink proforma respectively (as per specimen copies of proforma included in the tender document), which indicate authority/ order for such items.

15. INSURANCE POLICIES

SPCC-15

The Contractor shall not commence any work at site, until all the Insurance Policies, as required in terms of the General Conditions of Contract, have been submitted to the Employer. Renewal of the same if required due to extension of time of the completion or similar reasons is also the responsibility of the Contractor.

Notwithstanding anything to the contrary mentioned in the contract, Contractors have to submit all Insurance policies in original to the Client directly to sate the Client satisfy themselves regarding adequacy of the value of Insurance, validity etc. as per contractual clauses and furnish a copy to the Architect/ Consultant. The Contractor shall arrange for renewals on their own. Any omission to do so or delay in non-receipt of such information will be no excuse for failure to renew them or keep thee in force without a break.

16. INDEBTEDNESS AND LIENS

SPCC-16

The Contractor agrees to furnish the Employer from time to time during the

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progress of the work as requested, verified statements showing the Contractors total outstanding indebtedness in connection with the work covered by the contract. Before final payment is made, the Employer may require the Contractor to furnish the Employer with satisfactory proof that there are no outstanding debts or liens in connection with the contract. If during the progress of the work, the Contractor shall allow any indebtedness to accrue to sub-contractors or others and shall fail to pay or discharge same within five (5) days after demand then the Employer may withhold any money due to the Contractor until such debt is paid, or apply the same towards the discharge thereof.

17. INDEPENDENT CONTRACTOR **SPCC-17**
The Contractor agrees to perform this contract as an independent Contractor and not as a sub-contractor, agent or employee of the Employer.

18. WORK PERFORMED AT CONTRACTORS RISK **SPCC-18**
The Contractor shall take all precautions necessary and shall be responsible for the safety of the work and shall maintain all lights, guards, signs, temporary passages or other protection necessary for the purpose. All work shall be done at the contractors risk and if any loss or damage shall result from fire or from other cause, the Contractor shall promptly repair or replace such loss or damage free from all expenses to the Employer. The Contractor shall be responsible for any loss or damage to materials, tools or other articles used or held for use in connection with the work. The work shall be carried on and completed without damage to any work or property of the Employer or of others and without interference with the operation of existing machinery or equipment, if any.

During the contract period, the Contractor shall appoint at the site a Senior Engineer to the satisfaction of the Architect/ Consultant and shall continue in such appointment for three months after the grant of the "Virtual Completion Certificate" to him. The Architect/ Consultant shall be entitled to approve or disapprove without assigning reasons the appointment of such Engineer proposed by the Contractor. This condition shall be reckoned as being the essence of the contract and its breach shall make the contract revocable at the option of the Employer.

The Engineer so appointed shall coordinate the execution of work by Contractors of other trades in general and shall perform the following function in particular:

- 18.1 The Senior Engineer, in-charge of coordination shall be responsible for providing all the necessary support, required to be given by the **FURNITURE/CIVIL** Contractor by virtue of the contract, to the various services Contractors for the purpose of commissioning the testing of their respective services.
- 18.2 The Senior Engineer shall have adequate knowledge about the various services involved in the job to appreciate the importance of various interface activities to be performed by the main **FURNITURE/CIVIL** Contractor in the desired sequence so as to hold up the work of the services Contractors as regards commissioning and testing of their respective services.

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- 18.3 The Senior Engineer should have preferably past experience of shouldering similar responsibilities to appreciate the importance of this final critical phase of the project where utmost co-ordination is required for cutting down the delays in successful commissioning of the entire facility.

19. **CONSTRUCTION DRAWINGS** **SPCC-19**

The successful tenderer shall state on receiving the letter of intent, what drawings are yet to be issued by the Architect/ Consultant for execution purposes and what further details are required by him from the Architect/ Consultants. Silence on the part of the successful tenderer in this regard will be construed to mean that he has all the information that he needs for ordering out materials and for contractual purposes. Unless specifically asked for in writing, delays later claimed by the successful tenderer on account of drawings will not be construed as reasons for delay the execution of work.

Apart from clarifications sought during the periodic visits to site by the Architect/ Consultants representatives, the successful tenderer shall obtain all clarifications and the Architect/ Consultants drawings from their offices in Mumbai.

Extra / variation not registered within 3 weeks on receipt of drawings will not be entertained.

20. **COMPLETION DRAWINGS / ACCEPTANCE OF INSTALLATION** **SPCC-20**

The Contractor shall furnish 3 sets of drawings 'as erected' and approved by different statutory authorities in accepting the work in its entirety and completion.

The Contractor shall submit the written acceptance of the installation by the different statutory authorities in respect of the different components of the installation and commission the system in the presence of the Architect/ Consultant and Employer's representative before asking for the Virtual Completion Certificate.

21. **KEEPING THE AREAS AND ACCESS ROAD CLEAN** **SPCC-21**

The Contractor shall be required to maintain the site all the building areas in a neat and clean condition at all times to the satisfaction of the Architect/ Consultant.

The Contractor shall also be required to maintain all access roads to the site and within the site and keep, them free from all obstructions, material dropping etc. to the satisfaction of Architect/ Consultant and local authorities.

22. **TYPOGRAPHICAL OR CLERICAL ERRORS** **SPCC-22**

The Architect/ Consultant's clarifications regarding partially omitted particulars or typographical or clerical errors shall be final and binding on the Contractor.

23. **INFORMATION TO BE SUPPLIED BY THE CONTRACTORS** **SPCC-23**

The Contractor shall furnish the Employer the following:

- 23a Detailed Industrial statistics regarding the labour, employed by his etc.

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- 23b The Power of Attorney, name and signature of his authorized representative who will be in charge for the execution of the work.
- 23c A list of technically qualified persons employed by his for the execution of the work.
- 23d The total quantity and quality of materials used the work.

24. **TESTING OF WORKS, MATERIALS & PREPARATION OF SAMPLES**
SPCC-24

The Contractor shall arrange to test materials and / or portions of the works as instructed by the Architect/ Consultant/ Employer, wherever required/ possible as per Bureau of Indian Standards (BIS) at his own cost in order to prove their soundness and efficiency. If after any such test, the work or portions of the works are found to be defective or unsound the Contractor shall pull down and re-erect the same at his own cost.

Samples of various materials shall be submitted by the Contractor for approval prior to ordering out the same, wherever necessary the Contractor shall at his own cost, prepare samples to indicate the workmanship.

25. **COVERING UP OF WORKS** **SPCC-25**

The Contractor shall cover up and protect the works from the weather and from wear and tear as directed by Architect/ Consultant /Employer and shall suspend all wet operations during weather, which in the opinion of Architect/ Consultant, will be detrimental to the works.

26. **NOTICES** **SPCC-26**

The Contractor shall give all notices and pay all fees charges royalties, which may be levied/ leviable to any authority and shall comply with all Acts and Regulations for the successful completion of the Contract Works.

27. **MUNICIPAL REGULATION** **SPCC-27**

The whole of the work including sanitation is to comply with the requirements and Bye Laws of the concerned Municipal Corporation, local bodies & Chief Fire Officer and / or any other regulatory authorities as the case may be.

28. **MEASUREMENT TO BE RECORDED BEFORE WORK IS COVERED UP**
SPCC-28

The Contractor shall take joint measurement with the Architect/ Consultant's representative before covering up or otherwise placing beyond the reach of measurement any item of work. Should the Contractor neglect to do so, the same shall be uncovered at the Contractors expenses or in default thereof, no payment or allowance shall be made for such work or the materials with which the same was executed.

29. **WORK AT NIGHT** **SPCC-29**

If the Contractor is required to work at night in order to complete the work with-

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in the 'Time Schedule', the Contractor shall provide and maintain at his own cost sufficient lights to enable the work to proceed satisfactorily without danger. Approaches to the site also shall be sufficiently lighted by the Contractor. No extra payment will be made for night. Prior intimation of approval should also be taken from the Architect/ Consultant.

30. ISSUE OF EXTRA CONSTRUCTION DRAWING SPCC-30

Architect/ Consultants will supply six sets of drawings to the Clients for construction. Extra prints of drawings for construction will be issued on chargeable basis by Architect/ Consultant/Structural Consultant as detailed hereunder:

| | |
|---------|---|
| A0-Size | Rs.150/- each to Rs.200/- each depending on size of drawing |
| A1-Size | Rs.125/- each |
| A2-Size | Rs.100/- each |
| A3-Size | Rs.075/- each |
| A4-Size | Rs.050/- each |

The Contractor shall ensure that all the bills furnished from the Architect/ Consultant's Office in this regard are hachured, failing which the certificate for payment of Contractor's next Interim Bill will be withhold. The drawings are to be used for the project concerned.

31. DISPLAY OF NOTICES SPCC-31

Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, design, drawings, specifications, estimates, instructions orders or these conditions or otherwise concerning the work or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter.

31a If the Contractor considers that he is entitled to any extra payment or compensation in respect of the works over and above the amounts admitted as payable by the Architect/ Consultant or in case the Contractor wants to dispute the validity of any deductions or recoveries made or proposed to be made from the contract or raise any dispute, the Contractor shall forthwith give notice in writing of his claim or dispute to the Deputy General Manager (Premises) in writing in the manner and within the time aforesaid.

31b Deputy General Manager (Premises) shall give his decision in writing on the claims notified by the Contractor. The Contractor may within 30 days of the receipt of the decision of the Deputy General Manager (Premises) submit his claims to the conciliating authority along with all details and copies of correspondence exchanged between him and the Deputy General Manager (Premises).

If the conciliation proceeding are terminated without settlement of the disputes, the Contractor shall, within a period of 30 days of termination thereof

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shall give a notice to the Deputy Managing Director and Corporate Development Officer of the Bank for appointment of an arbitrator to adjudicate the notified claims failing, which the claims of the Contractor shall be deemed to have been considered absolutely barred and waived.

Except where the decision has become final, binding and conclusive in terms of the contract, all disputes or differences arising out of the notified claims of the Contractor as aforesaid and all claims of the Bank shall be referred for adjudication through arbitration by the sole arbitrator appointed by the Deputy Managing Director and Corporate Development Officer. It will also be no objection to any such appointment that the Arbitrator so appointed is a Bank Officer and that he had to deal with the matters to which the contract relates in the course of his duties as Bank Officer. If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another sole Arbitrator shall be appointed in the manner aforesaid by the said Deputy Managing Director and Corporate Development Officer. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

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

It is also a term of this contract that no person other than a person appointed by such Deputy Managing Director and Corporate Development Officer as aforesaid should act as arbitrator.

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

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

It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issues the notice to both the parties calling them to submit their statement of claims.

32. WORK TO BE CONTINUED DURING THE PENDENCY OF THE ARBITRATION SPCC-32

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

33. LIEN ON SUMS PAYABLE TO THE CONTRACTORS SPCC-33

Any sum of money due and payable to the Contractor including any deposits returnable to them under this contract may be withheld or retained by the Employer, against any claims of the Employer.

34. APPROVAL OF MOCK-UPS AND SAMPLES **SPCC-34**
It will be the Contractors responsibility to obtain written approval of mock-ups and samples from the Architect/ Consultant and Employer. If this is not done, such items where these materials are used will be rejected by the Architect/ Consultant / Employer.
35. WORKING TO SATISFACTION OF THE EMPLOYER **SPCC-35**
For any item, if work is not executed up to the satisfaction of the Employer, such as in case of items for painting and polishing, normally primer and three coats should suffice. However, to achieve the final finish, to Employer's/ Architect/ Consultants satisfaction, it may become necessary to have more than three coats. This will have to be done by the Contractor at no extra cost.
36. NON-AVAILABILITY OF SPECIFIED MATERIALS/ ITEMS **SPCC-36**
In case of materials/items, which are not available, the Contractor shall have to submit a letter from manufacturer to that effect. After proper verification, alternative material may be selected by the Employer / Architect/ Consultant. In the case there will not be any increase of the quoted rates. However, if accepted alternative material/item is cheaper the cost benefit is to substantiated and needs to be approved by the Employer.
- 36.1 PEST CONTROL TREATMENT
Necessary pest control and anti-termite treatment if required for all FURNITURE work to be executed by the Pest Control agencies, who are the members of the Pest Control Association of India. All wood work must be treated before use. The Contractor should obtain prior approval from the Architect/ Consultant/Employer before placing order for any specific material/agency.
37. UNAUTHORIZED PERSONS: **SPCC-37**
No unauthorized persons are to be allowed on the site. The Contractor shall instruct all such persons to keep out and shall take steps to prevent trespassing.
38. TERMINATION: **SPCC-38**
In the event of the Contractor failing to complete the works within the stipulated period of completion as mentioned hereof, the Employer may, notwithstanding anything contained to the contrary in the contract, terminate at any time the contract without being liable in any manner whatsoever to the Contractor, by giving 30 (thirty) days notice in writing to the Contractor and proceed to complete or get completed the works which have remained incomplete/ not done at the time of such termination at the risk and cost of the Contractor.
39. STATUTORY OBLIGATIONS, NOTICE, FEES AND CHARGES, AS APPLICABLE: **SPCC-39**
a) The Contractor shall comply with and give all notices required by any act, any instrument rule or order made under any Act, or of any regulation or by-laws of Municipal Corporation and any other local body or authority or of any agency which has any jurisdiction with regard to the works or with whose systems the same we are or will be connected (all requirements to be complied with being referred to in these Conditions as the statutory requirements)

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b) If the Contractor shall find any divergence between the statutory requirements and all or any of the contract documents or any variation instruction issued in accordance with these Conditions, he shall immediately give to the Employer/Architect a written notice specifying the divergence.

c) If the Contractor gives notice under paragraph (b) of this sub-clause or of Employer/ Architect shall otherwise discover or receive notice of a divergence between the statutory requirements and all or any of the contract documents or any variation instructions issued in accordance with these conditions, the Employer shall within 7 (seven) days of discovery or on receipt of a notice issue instructions in relation to the divergence.

d) If in any emergency compliance with paragraph (a) of this sub-clause requires the Contractor to supply materials or execute work before receiving instruction.

e) under paragraph (c) of this sub-clause the Contractor shall supply such limited materials and execute such limited work as are reasonably necessary to secure the statutory requirements.

f) The Contractor shall forthwith inform the Employer/ Architect of the emergency and of the steps that he is taking under this paragraph of these conditions.

g) Work executed and materials supplied by the Contractor under sub-paragraph (i) of this paragraph shall be deemed to have been executed and supplied pursuant to Employer's instruction in accordance with these Conditions provided that the emergency arose because of a divergence between the statutory requirements and all or any of the documents referred to in these Conditions or any variations, instructions issued in accordance with these Conditions.

h) Provided that the Contractor complies with paragraph (b) of this sub-clause, the Contractor shall not be liable to the Employer under this Contract. If the works do not comply with the statutory requirements from the Contractor having carried out work in accordance with the documents referred to these Conditions.

ii) The Contractor shall pay and indemnify the Employer against liability in respect of any fees or charges (including any rates or taxes) legally demandable under any Act, any instrument rule or order made under any Act, law or any regulation or below of any local authority or of any statutory or agency in respect of works.

iii) It will be the Contractor's sole responsibility and obligation to arrange for blasting license from the relevant authorities; if the excavation requires blasting. The Contractor will have to store the blasting powder in a suitably constructed store as per regulation of the explosive department and local bodies.

40. **ASSIGNMENT AND SUBLETTING:**

SPCC-40

The whole of work included in the contract shall be executed by the contractor and he shall not directly entrust and engage or indirectly transfer assign or underlet the contract or any part or share thereof or interest therein without the written consent of the Employer through the architect and no undertaken shall relieve the contractor from the responsibility of the contractor from active superintendence of the work during its progress.

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41. ADDRESS FOR SERVICE

SPCC-41

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

01. Address for Employer

**ASSISTANT GENERAL AMANAGER (P&E),
STATE BANK OF INDIA
Local Head Office,
Pt. J. N. Marg,
Bhubaneswar, 751001**

02. Address for Architect/ Consultan

**ARCHITECT NARAYAN & ASSOCIATES PVT LTD
303-304, Antarisksh building,
makwana road, marol naka,
andheri(E), Mumbai-400059.**

03. Address for the Contractors

SIGNATURE OF THE TENDERER

Signature of tenderer

Date

Address:

List of Mandatory Test

| Materials | Test | Frequency |
|-----------|-------------------------------|---|
| Sand | Silt Content | 50 cum and above |
| | Sieve analysis | Same as above |
| Aggregate | Particle size distribution | 25 cum and above |
| Bricks | Compressive strength | 20000 and above |
| RCC | Slump | Once a day or as desired for major RCC work |
| | Cube strength | 20cum and above, min 3 cubes to be tested |
| Cement | Compressive strength | Test certificate to be submitted |
| Steel | Yield stress, %age elongation | Test certificate to be submitted |

Signature of tenderer

Date

Address:

Model rules for the protection of health and sanitary arrangement for workers

Contractor has to arrange first aid to workers such as adequate supply of sterilized dressings, sterilized cotton wool. These shall be kept under the charge of responsible person who shall be available during working hours. Covid-19 protocol shall be strictly followed. Some conveyance facility such as car shall be kept readily available to take care of injured person to the nearest hospital.

Contractor shall arrange portable drinking water facility including storage facility so that these can be easily available to workers. Drinking water shall not be located near latrine and bathroom.

Adequate washing and bathing facility shall be provided for man and woman separately with proper drainage facility. Similarly, separate urinals, toilets shall be provided for man and woman. A poster showing the figure of man and woman shall be exhibited at the entrance of latrine of respective sex. Latrine and urinals etc., shall be constructed of masonry wall with finishing to keep it neat and clean regularly. The septic tank or crèche shall be constructed for disposal of excreta etc. proper ventilation shall be provided.

Separate ventilated shelter shall be provided for rest of man and woman separately with height of shelter shall be 3m. The temporary shed shall be thatched roof of GI Sheet roof with mud flooring and 50cm above ground level. Crèches shall be provided at work place for children under 6 belonging to such women. Two huts will be provided separately for game and bed room each. It shall be thatched roof, mud floor and walls and planks spread over the mud floor and covered with matting. It shall be sufficiently ventilated. One Dai for each hut shall be provided by contractor and toys and other similar materials shall be provided for children.

A coked food canteen on moderate scale shall be provided for the benefit of workers wherever required.

The contract should quote of item f tender considering above factors accordingly.

Format of Guarantee Bond for Anti-termite Treatment (in Rs.100 Non-Judicial Stamp Paper)

This agreement made this _____ day of _____ two thousand _____ between _____ (name of employer) a body corporate constituted under the _____ name of act/ act 19____ having its head office at _____ (herein called employer) of the one part and _____ (name of Firm/contractor) (hereinafter called "The guarantor) of the project.

WHEREAS THIS AGREEMENT is supplementary to a contract (Hereinafter called the contract dated _____ and made between the Employer of the one part and the Guarantor of the other part) where by the firm from any infestation of termites. And whereas the Guarantors agreed to give guarantee to the effect that the said buildings / structurers shall remain free from any infestation of termites for a minimum of period of ten years (10 years) from the date of completion f pre-construction anti-termite treatment carried out as per the relevant IS Code.

Now the Guarantor hereby agrees to make good all defects and render the buildings/ structurers free from any infestation of termites, during this period of guarantee and to the satisfaction of the employer. The guarantor also agrees to take up such rectification work at his own cost and within one week from the date of issue of notice from the employer, calling upon him to rectify the defects. The decision of employer as to the cost payable by the guarantor will be final and binding, in case guarantor fails to commence the work as per above notice, and the work got done through another agency or contractor. That if the guarantor fails to execute the pre-construction anti-termite treatment or commits breach there under, then the guarantor will indemnify the principal and the successor against all losses of any default on the part of the guarantor in performance and observance of this agreement. As to the amount of loss and damage and or cost incurred by the employer, the decision of employer will be final and binding.

In witness whereof these presents have been executed by the obligator _____ and by the _____ and for and on behalf of the employer on the day, month and year first above written.

Signed and delivered by _____ (employer) by the hands of Sri _____ in the presence _____

Signed and delivered by _____ (Contractor) in the presence of _____.

Proforma of Guarantee Bond for water proofing treatment (Rs 100 Non-Judicial stamp paper)

The AGM (P&E),

SBI, LHO,

Bhubaneswar

Water proofing treatment to the basement, retaining wall, roofs including stair roofs underground reservoirs, overhead water tanks, sunken floors to the "External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha."

1. We hereby certify that the water proofing treatment to the above places to the construction of multi-storeyed building for SBI, Bhubaneswar described in the schedule of quantities and specifications have been done as per the specification, in accordance with terms and conditions under which he said work has been awarded to us.
2. We hereby guarantee that the basement with retaining wall, roofs, stair roofs, underground reservoir, overhead reservoir and sunken floors of the construction of building for SBI, Bhubaneswar shall be in water proof condition for a period of 5 years from the date of handing over of the completed works to SBI.
3. In the event of any treatment necessary subsequently during the period of guarantee of the said basement with retaining wall, roofs, stair roofs, underground and overhead reservoir, sunken floors of the building required inspection and treatment shall be carried out by us at our own cost.
4. The quotation whether further treatment is or has become necessary during the said guarantee period shall be decided by the bank and decision in this regard shall be final and binding.
5. Notwithstanding anything contained hereinbefore, we shall not be held responsible for any leakage caused by alteration, earthquake or other action causing damage the said basement with retaining wall, roofs, sunken floor stair roof, underground and overhead reservoir of said building.

Witness and address

Signature of contractor with seal

Technical specification of Materials:

1. Materials shall be of approved quality as mentioned in list. Prior approval of materials from architect/employer other than specified is necessary due to non-availability of listed materials. Sample of materials shall be approved by architect/ employer before placing order.
2. Materials shall be tested in govt. approved laboratory. Frequency shall be as listed in table. Test certificate of steel, cement, AAC block shall be submitted by contractor for each lot of materials procured for construction. Cos of test shall be borne by contractor including transportation cost and collecting material sample.
3. All equipment and facilities for carrying out field tests on materials shall be provided by the contractor without any extra cost.
4. All works shall be carried out as per specifications given in the SOQ. If there is any discrepancy, architect/ employer will explain the specification. If there is any doubt, CPWD specification shall be followed.
5. Steel scaffolding, centring and shuttering shall be used for RCC work (Slab, beam, column, lintel chajja etc.).
6. Surface of Steel reinforcement before placing in position shall be cleaned of loose rust or scaling, dust, grease, and any other objectionable substances as required and directed. Bar bending schedule shall be prepared by contractor as per structural drawing issued and shall be got approved by architect/employer.
7. Binding wire shall be used for securing bars (18-gauge soft annealed steel). No concreting shall be commenced until employer/architect have inspected the reinforcement in position and until their approval have been obtained. A notice of at least 24 hours shall be given to employer / architect by the contractor for inspection of reinforcement. If in the opinion of employer/architect, any materials are not in accordance with specification or the reinforcement is incorrectly spaced, bend or otherwise defective. The contractor shall immediately remove such material from the site and replace with new and rectify any other defects in accordance with the instruction of employer/architect to their satisfaction.
8. Cover to reinforcement shall be as per structural drawing /IS 456.Pre cast cover of ASTRA make shall be used.
9. For brick masonry, plastering and finishing work, bamboo scaffolding shall be used and safety precaution shall be carried out.

FORM 1

PROFORMA OF APPLICATION FOR REGISTRATION OF ESTABLISHMENT EMPLOYING CONTRACT LABOUR

| | | |
|-----|--|--|
| 1 | Name and location of the Establishment. | |
| 2 | Postal address of the Establishment. | |
| 3 | Full name and address of the Principal Employer. (furnish father's name in the case of individuals) | |
| 4 | Full name and address of the Manager or the person responsible for the supervision and control of the Establishment. | |
| 5 | Nature of work carried on in the Establishment. | |
| 6 | Particulars of Contractors and Contract Labour: | |
| (a) | Names and address of the Contractors | |
| (b) | Nature of work in which contract labour is employed or is to be employed. | |
| (c) | Maximum number of contract labour to be employed any day through each Contractor. | |
| (d) | Estimated date of commencement of each contract work under each Contractor. | |
| (e) | Estimated date of termination of employment of contract labour under each Contractor. | |
| 7 | Particulars of Treasury Receipt enclosed.(Name of the Treasury, Amount and Date) | |

I hereby declare that the particulars given above are true to the best of my knowledge and belief.

Principal Employer
Seal and Stamp

FORM XII

PROFORMA OF REGISTER OF CONTRACTORS

1. Name and addresses of the Principal Employer _____
2. Name and address of the Establishment _____

| Sr. No | Name address and of con- the tractor | Nature of work on contract | Location of contract work | Period of contract from to | Maximum number of workmen employed by the contractor |
|--------|--------------------------------------|----------------------------|---------------------------|----------------------------|--|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

PROFORMA OF SITE ORDER BOOK

Name of the work _____

Date of Commencement _____

| Sr. No | Remarks/ Instructions of the site Engineer/ Architect | Dated Initials of site Engineer/ Architect | Initials of the Contractor for having received the instructions | Action taken with date | Dated initials of the site Engineer | Remarks of the Architects/ Bank Officials |
|---------------|--|---|--|-------------------------------|--|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | | | |
| | | | | | | |

PROFORMA FOR APPLICATION BY CONTRACTOR FOR EXTENSION OF TIME

| | | | | |
|-----|---|--|--------------|-------------|
| 1. | Name of the Contractor | | | |
| 2. | Name of the work as given in the Agreement | | | |
| 3. | Agreement WO | | | |
| 4. | Tender amount | | | |
| 5. | Date of commencement of work | | | |
| 6. | Period allowed for completion as per agreement | | | |
| 7. | Date of completion as per agreement | | | |
| 8. | Period for which extension of time has been given | | | |
| | | <u>Date</u> | <u>Month</u> | <u>Year</u> |
| | | | | |
| | a) | 1 st extension vide Bank's Letter No. | | |
| | b) | 2 nd extension vide Bank's Letter No. | | |
| | c) | 3 rd extension vide Bank's Letter No. | | |
| 9. | Reasons for which extensions have been previously given (copies of the previous applications should be attached) | | | |
| | | | | |
| 10. | Period for which extension is applied for and the reasons thereof including hindrances, time for extra work assigned, if any etc. | | | |
| | | | | |

Signature of Contractor

Recommendations of Architects

Signature of Architect.

CONTRACT EXECUTION

EXTENSION OF TIME PERIOD FOR THE WORK OF _____

| | | |
|-----|---|-----------|
| 1. | Name of work & E.C. sanction | |
| 2. | Name of Contractor | |
| 3. | Contract Cost | |
| 4. | Date & Reference of work order | |
| 5. | Date of start of work(As per work order) | |
| 6. | Time period as per tender | |
| 7. | Scheduled Date of completion | |
| 7.A | Interim schedule if any | |
| 8. | No. of extensions | |
| 9. | Date & Reference of last extension | |
| 10. | Reasons for delay and period of delay for each reason including corrective action taken by Bank/Architect (quote & attach references wherever necessary) i) ii)etc | |
| 11. | Total delay due to above |days |
| 12. | Responsibility for each reason for delay (a) Bank (b) Architect (c) Contractor (d) unforeseen circumstance (e) force measures etc. and corrective action not been taken (Attach references of letters etc.) | |
| 13. | Present status of work – Physical progress, % progress & cost of work remaining/ incomplete | |
| 14. | Any interim schedule / milestone achieved | |
| 15. | Any other hold/restraint envisaged in the completion of the remaining work. suggest corrective actions necessary | |
| 16. | Recommendation for the no. of days of extension along with reasons | |
| 17. | Financial loss to the Bank if any due to this extension and recommendations for liquidated damages if justifiable (State reasons) | |

Engineer-in-charge

Recommendation approved

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Proforma for cement and steel consumption statement, running bill, final bill, deviation statement and other relevant proforma shall be collected from consultant or bank.

Quantities of theoretical consumption of cement for major items of work shall be as per CPWD norms wherever applicable.

Note: - Item of work site Engineer shall refer to the C.P.W.D. Specifications and norms. In case of coefficient is available for a specific item, the decision of SBI/Architect shall be final and binding on the contractor.

LETTER FOR GRANTING EXTENSION OF TIME

To

Dear Sirs,

Bank's Office Building / Staff / Officer's Quarters under

Construction at _____ work- Extension of Time

Refer your letter No. _____ dated _____ in connection with the grant of extension of time for completion of the captioned work.

The date of completion of the above-mentioned work is _____ as stipulated in the contract. Extension of time for completion of the work upto _____ is, hereby granted by the Bank without prejudice to the right of the Bank to recover liquidated damages in accordance with the provisions of the contract.

Notwithstanding the extension hereby granted, time is and shall continue to be the essence of the said contract.

Yours Faithfully,

Architects

SPECIMEN OF LETTER GIVEN TO THE CONTRACTOR IN REGARD TO THE RECTIFICATION OF DEFECTIVE WORK AND REMOVAL OF SUBSTANDARD MATERIAL

To

M/s. _____

Sir,

SUB: NATURE OF WORK

I, whereas the above work has been awarded to you under the subject contract and the same is in progress/the same has been completed.

2. Whereas the items of works as detailed in schedule attached herewith have been executed with unsound, imperfect and unskillful workmanship/with materials of inferior description and that materials and/on articles provided for the execution of the work are unsound and of a quality inferior to the contracted for.

3. Whereas the materials and/or articles provided by you for execution of the work as detailed in the schedule hereto are unsound and of quality inferior to that contracted for.

4. Now you are hereby called upon to rectify or remove and reconstruct forthwith each item of work as detailed in the said schedule of work in whole or in part as the case may require with sound, perfect and skillful workmanship and/or with materials and articles of sound and proper quality as per the contract at your own cost and charge.

5. I, in exercise of the powers conferred on me by the aforesaid agreement, hereby give you notice to remove the cause set out above within.....
....days to my satisfaction falling which action will be taken against you under clause (8).....of the agreement. Yours faithfully,

Asstt. General Manager (Premises& Estate)/

Dy. General Manager (Premises)

FORMAT OF PRE-CONTRACT INTEGRITY PACT

State Bank of India hereinafter referred to as “The Principal”.

Andhereinafter referred to as “The Bidder/Contractor”

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for

.....The Principal values full compliance with all relevant laws of the land, rules, regulations, and economic use of resources and of fairness/transparency in its relations with its Bidder and / or Contractor. In order to achieve these goals, the Principal will appoint an Independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal.

1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
 - a. No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
 - b. The Principal will during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the process or the contract execution.
 - c. The Principal will exclude from the process all known prejudiced persons.

2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or it there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

1. The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

- a. The Bidder(s) / contractor(s) will not, directly or through any other persons or firm, offer promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage or during the execution of the contract.
- b. The Bidder(s)/Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- c. The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s) /Contractors will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- d. The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly, the bidder(s)/contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any.

Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" as annexed and marked as Annexure.

- e. The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2. The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3: Disqualification from tender process and exclusion from future contracts: If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as per the procedure mentioned in the “Guidelines on Banning of business dealings”.

Section 4: Compensation for Damages

1. If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.
2. If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the Contract value or the amount equivalent to Performance Bank Guarantee.

Section 5: Previous Transgression

1. The Bidder declares that no previous transgressions occurred in the last three years with any other company in any country conforming to the anti-corruption approach or with any other public sector enterprise in India that could justify his exclusion from the tender process.
2. If the bidder makes incorrect statement on this subject, he can be disqualified from the tender process for action can be taken as per the procedure mentioned in “Guidelines on Banning of business dealings”.

Section 6: Equal treatment of all Bidders/Contractors/Subcontractors.

1. The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.
2. The Principal will enter into agreements with identical conditions as this one with all bidders, contractors and subcontractors.
3. The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7: Criminal charges against violation Bidder(s)/Contractor(s)/Sub-Contractor(s)

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

Section 8: Independent External Monitor/Monitors

- (1) The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- (2) The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the Chairman, SBI.
- (3) The Bidder(s)/Contractor(s) accepts that the Monitor has the right to access without restriction to all project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/Contractor(s)/ Subcontractor(s) with confidentiality.
- (4) The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- (5) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- (6) The Monitor will submit a written report to the Chairman, SBI within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.
- (7) Monitor shall be entitled to compensate on the same terms as being extended to / provided to Independent Directors on the SBI Board.
- (8) If the Monitor has reported to the Chairman SBI, a substantiated suspicion of an offence under relevant IPC/PC Act, and the Chairman SBI has not,

within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.

(9) The word "Monitor" would include both singular and plural.

Section 9 – Pact Duration

This pact begins when both parties have legally signed it. It expires for the Contractor 10 months after the last payment under the contract, and for all other Bidders & months ---- the contract has been awarded. If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by Chairman of SBI.

Section 10 – Other provisions

- This agreement is subject to Indian Law, Place of performance and jurisdiction is the Registered Office of the Principal, i.e. New Delhi.
- Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

**(For & on behalf of the Principal Employer)
(Office Seal)**

**(For & On behalf of Bidder/ Contractor)
(Office Seal)**

Place -----

Date -----

Witness 1: (Name & Address) _____

Witness 2: (Name & Address) _____

FORMAT OF UNDERTAKING IN CONNECTION WITH PAYMENT OF ADVANCE ON MATERIALS BROUGHT BY THE CONTRACTOR TO THE SITE

The Undertaking made this _____ day of _____ 20____ between the State Bank of India, _____ and _____ having its _____ office at _____ (hereinafter called the Bank) of the one part and _____ (hereinafter called the contractors of the other part).

The Bank and the Contractors have entered into an Agreement dated _____ hereinafter called as the said agreement and in terms of Clause No. _____ of the conditions in the agreement, the Bank has agreed that the Contractors will be paid an advance of 75% of the cost of non-perishable building materials brought by the Contractor to the site for consumption in the works at the discretion of the Bank.

The Contractors have applied to the Bank that they be allowed advances on the security of materials absolutely belonging to them and brought by them to the site of work. The Bank has agreed to do so on the terms and conditions hereinafter set out.

Now this Letter of Undertaking witnesses that in consideration of the said agreement and in consideration of the amount paid / payable to the Contractors by the Bank and./ or any further advances as may be made to the Contractors as aforesaid, the Contractors hereby agree with the Bank and undertake as under :

- (i) The amount advanced by the Bank to the Contractors as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractors in or towards expediting the execution of the said works and for no other purpose whatsoever.
- (ii) That the materials which have been offered to and accepted by the Bank as security are absolutely the Contractor's own property 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 Contractors indemnify the Bank against all claims to any materials in respect of which an advance has been made to them as aforesaid.
- (iii) That the materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractors solely in the execution of the said works in accordance with the directions of Assistant General Manager (Premises & Estate) of the Bank and in accordance with the terms of the said agreement.

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- (iv) That the Contractors shall take at their own cost all the necessary and adequate arrangement 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 their own responsibility and shall at all times be open to inspection to the Bank's Engineers or any Officer authorized by the Bank. In the event of the materials or any part thereof being stolen, destroyed or damaged, the Contractor will further replace the same with other materials of like quality or repair and make good the same as required by the Bank.
- (v) That the said materials shall not or on any account be removed from the site of the said works except with the written permission of the Assistant General Manager (Premises & Estate) the Bank.
- (vi) That the advances shall be repayable in full when or before the Contractors receive payment from the Bank of the price payable to them for the said works under the terms and the provisions of the said agreement provided that if any intermediate payments are made to the Contractors on account of work done, then on occasion of each such payment, the Bank will be at liberty to make a recovery from the Contractor's bill for such payment by deducting therefrom the value of the said materials then 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.
- (vii) That if the Contractors 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 advance or advances that may still be owing to the Bank, shall immediately, on the happening of such default, be repayable by the Contractors to the Bank together with interest thereon at 12% 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 Bank in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractors and the Contractors hereby covenant and agree with the Bank to repay and pay the same respectively to him accordingly.
- (viii) That the Contractors hereby charge all the said materials with the repayment to the Bank of the sum or 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 powers contained therein if any whenever the covenant for payment and repayment hereinabove contained shall become enforceable and the money owing shall not be paid in accordance therewith, the Bank may at any time thereafter adopt all or any of the following courses as he may deem best :

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- (ix) (a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractors in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractors 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 Contractors, they are bound to pay the same to the Bank 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 payable to the Bank under these presents and pay over the surplus (if any) to the Contractor.
- (c) Deduct all or any part of the money owing out of the Security Deposits or any sum due to the Contractor under the said agreement.
- (x) That except in the event of such default on the part of the Contractors as aforesaid, no interest shall be payable on the said advance.
- (xi) That in the event on 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 of effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the Officer-inCharge, Premises Department, whose decision shall be final and no appeal shall lie against his decision before any court, arbitrator or authority.
- (xii) The provision of this Undertaking shall be deemed to be supplemental to the said agreement.

IN WITNESS WHEREOF the Contractors have set their hands to these presents the day and year first hereinabove written.

Signed, sealed and delivered by the said contractors in the presence of

Witness :Signature

Name
Address

Witness :Signature

Name
Address

FORMAT OF CERTIFICATE OF ADVANCE PAYMENT BY ARCHITECT

| | | |
|----------------------------------|------------------------------|--------------------------------------|
| Certificate No. Interim / | Dated | |
| Client: | Project No. | Building work / Interior work |
| | Particulars: | |
| Contractor: | Contract / Letter No. | Dated: |
| | Contractor's Bill No. | Dated: |

This is to certify that the amount given below (*) is due to your Contractors for the work done by them and/or against materials delivered at site and/or for advance towards contract on the above referred project.

Advance against contract Rs _____
 Less: Advance adjusted to-date Rs. _____
 Balance Advance Rs. _____
 Advance against material delivered at site Rs. _____
 Amount of work done to-date Rs _____
Total Rs _____
 Less: Retention on work done Rs _____
 Less: Previously certified upto Rs _____
 PRESENT CERTIFICATE (*)Rs. _____
 RUPEES.....

The cost of cement or any other material supplied by you or payments made by you directly, if any and not covered herein above, should be adjusted before making the payment of the certified amount (*).

Necessary Deduction U/S194C of the income Tax 1961 and sales tax may be made before paying the above certified amount.

By a copy of this letter, we are intimating the Contractors to call on you for the necessary payment.

Remarks if any :

The details of Insurance policy are given in the next page.

Signature of Architects

Enclosures: Bill

BANK GUARANTEE IN LIEU OF SD/ASD

Place:

Date:.....

(On non-judicial stamp paper of Rs.-----/-)

BANK GUARANTEE IN LIEU OF SECURITY DEPOSIT

B.G.No. _____ Value Rs. _____

State Bank of India,

(Address)

Sub: Bank Guarantee of Rs.....towards Security Deposit for the work offer State Bank of India.

(Name of Branch/Office)

Dear Sir,

WHEREAS (Name and address of contractor/ vendor) (hereinafter called the Contractor) have entered into contract for (Name of Work) with State Bank of India (SBI) as mentioned in the letter of SBI's Consultants (Name & address of consultants) vide their letter No..... datedand the correspondence and tender relating thereto which is hereinafter referred to as "the said contract" the Contractor has now agreed to produce a Bank Guarantee amounting to 2% of the contract value less earnest money deposit of Rs.....(Rupees only), to State Bank of India for performing their part of the contract obligations.

AND WHEREAS in terms of said contract, the contractor is required to furnish to State Bank of India a Guarantee of a Scheduled Bank for a value of Rs..... to be valid upto (date).

AND WHEREAS (Name of Bank and its branch) having their office at (address) the Guarantor, at the request of the contractor hereby furnishes a PBG in favour of State Bank of India and Guarantees in the manner hereinafter appearing.

In consideration of the premise, we (name of Bank and its branch) having our office at (address) here after called the "Guarantor" (which expression shall include its successors and assigns) here by expressly, irrevocably & unreservedly under-

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take and guarantee under that if the Contractor fails to execute the work according to his obligations under the said contract, then notwithstanding any dispute between State Bank of India and the contractor the Guarantor shall, on demand without demur and without reference to the contractor pay to State Bank of India immediately any sum claimed by State Bank of India under the said contract up to a maximum amount of Rs. _____ (Rupees only).

In case the amount demanded by State Bank of India is not paid within 48 hours of receipt of demand, the Guarantor agrees to pay the aforesaid amount of Rs. _____/- (Rupees _____ only).

- (i) Such payment shall be notwithstanding any right the contractor may have directly against State Bank of India or any disputes raised by the Contractor with State Bank of India or any suits or proceedings pending in any competent court or before any arbitrator. State Bank of India's written demand shall be conclusive evidence to the Guarantor that such payment is payable under the terms of the Contract and shall be binding in all respect on the guarantor.
- (ii) The Guarantor shall not be discharged or released from the the undertaking and Guarantee, by any arrangement, variations made between SBI and the Contractor and or indulgence shown to the contractor by SBI, with or without the consent and knowledge of the guarantor or by alterations in the obligations of the contractor by any forbearance, whether as to payment, time performance or otherwise.
- (iii) This guarantee shall remain valid until or as may be caused to be extended by the contractor or until discharged by SBI in writing whichever is earlier.
- (iv) This guarantee shall be a continuing guarantee and shall not be revocable during its currency except with the previous written consent of SBI.
- (v) This guarantee shall not be affected by any change in the constitution of the contractor, by absorption with any other body or corporation or dissolution or otherwise and this guarantee will be available to or enforceable against such body or corporation.
- (vi) In order to give effect to this guarantee SBI will be entitled to act as if the Guarantor were the Principal debtor and the Guarantor hereby waives all and any of its rights or surety ship.
- (vii) This guarantee shall continue to be in force notwithstanding the discharge of the contractor by operation of law and shall cease only on payment of the full amount by the Guarantor to SBI of the amount hereby secured.
- (viii) This guarantee shall be in addition to and not in substitution for any other guarantee or security for the contractor given or to be given to SBI in respect of the said contract.
- (ix) Any notice by way of request and demand or otherwise here under may be sent by post or any other mode or communication to the guarantor addressed as aforesaid and if sent by post it shall be deemed to have been

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given at the time when it would be delivered in due course of post and in providing such notice when given by post it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of SBI that the envelope was so posted shall be conclusive.

- (x) These presents shall be governed by and constructed in accordance with Indian Law.

Notwithstanding anything contained hereinbefore the liability of the guarantor under this guarantee is restricted to a sum of Rs._____.

This guarantee will remain valid upto _____ unless a demand or claim under this guarantee is made in writing on or before _____ the guarantor shall be discharged from all liability under the guarantee thereafter.

Dated the

For (Name of Bank)

(Signature/s with designation/s of signatory/ies)

(Name and Stamp of Bank)

FORMAT OF MEASUREMENT BOOK

1ST Page:

STATE BANK OF INDIA

.....office,

Measurement Book No.

(Pages 1 to.....)

This book is issued to

Shri.....

Signature of A.G.M. (Premises & Estate) / D.G.M. (Premises)

Certified that this book contains..... pages

Signature of the official (to whom the book is issued)

MEASUREMENT BOOK PAGES NOS. 1 TO.....

| Item No. | Description | Measurement No.LB D/H | Quantity | Remarks |
|----------|-------------|--------------------------|----------|---------|
| | | | | |

Site Engineer Architect Contractor

Checking/Test checking Engineer Date of checking/Test checking

NOTE :

Checking and test checking pertains to items wherever initialed.

FORMAT FOR RUNNING BILL**I. Running A/C Bill**

- (i) Name of Contractor / Agency:
(ii) Name of work:
(iii) Sr, No. of this Bill:
(iv) No. and date of previous bill:
(v) Reference to Agreement No.:
(vi) Date of written order to commence:
(vii) Date of completion as per agreement:

| Sr. No. | Item Description | Estimated Quantity | Unit | Rate (Rs.) | Tendered Amount (Rs.) | |
|-------------------------|------------------|--------------------|--------------|--------------------|-----------------------|--------|
| 1. | 2. | | 3. | 4. | 5. | |
| | | | | | | |
| Up to previous R/A Bill | | Up to date (Gross) | | Present Bill (7-6) | | Remark |
| Qty. | Amount (Rs.) | Qty. | Amount (Rs.) | Qty. | Amount (Rs.) | |
| 6. | | 7. | | 8. | | 9. |
| | | | | | | |

Note :

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- (i) If part rate is allowed for any item, it should be _____ indicated with reasons for allowing such a rate 'Net value since'
- (ii) If adhoc payment is made, it should be mentioned previous bill specifically.

II. ACCOUNT OF SECURED ADVANCE, IF ADMISSIBLE ON MATERIALS HELD AT SITE BY THE CONTRACTOR

| No. | Item | Quantity | Unit | Amount | Remarks |
|-----|------|----------|------|--------|---------|
| 1. | 2. | 3. | 4. | 5. | 6. |
| | | | | | |

Total value of materials at site.

Secured Advance @ _____ % of above value B

CERTIFIED (i) that the materials mentioned above have actually been brought by the contractor to the site of the work and no advance on any quantity of any of this item is outstanding on their security (ii) that the materials are of imperishable nature and are all required by the contractor for use in the work in connection with the items for which rates of finished work have been agreed upon.

Dated signature of Site

Engineer preparing the bill

Designation _____

Dated signature of Bank's

Architects

(Name of the Architects)

Dated signature of Contractor

CERTIFICATE

The measurements on the basis of which the above entries for the Running Bill No. _____ were made have been taken jointly on _____ and are recorded at pages _____ to _____ of measurement book No. _____.

Signature and Signature and date of Signature and date of

Date of contractor Architect's representative the

Site Engineer (seal)

The work recorded in the above mentioned measurements has been done at the site satisfactorily as per tender drawings, conditions and specifications.

Architect Site Engineer Bank's Engineer

**TECHNICAL SPECIFICATIONS OF VARIOUS TRADES
INDEX**

| Sl.no | Description | Page |
|-------|--|------|
| 1 | VOLUME I TECHNICAL SPECIFICATION OF CIVIL, REPAIR, DEMOLITION/DISMANTLING, FURNITURE, INTERIOR FURNISHING & ALLIED WORKS | 110 |
| 2 | VOLUME-II TECHNICAL SPECIFICATIONS OF PHE WORKS | 175 |
| 3 | VOLUME -III TECHNICAL SPECIFICATIONS OF ELECTRICAL WORKS | 187 |
| 4 | VOLUME -IV TECHNICAL SPECIFICATIONS OF DATA CABING & NETWORKING WORKS | 265 |
| 5 | VOLUME-V TECHNICAL SPECIFICATIONS OF FIREFIGHTING WORKS | 273 |

Volume – I

TECHNICAL SPECIFICATIONS FOR

- i. CIVIL WORKS-EXTERNAL, ROAD WIDENING, DRAIN WORK & LANDSCAPE WORK & ALLIED WORKS
- ii. INTERNAL CIVIL WORKS-DISMANTLING/DEMOLITION, PEST CONTROL, MASONARY & ALLIED WORKS, FLOORING, CLADDING & GRANITE WORKS & WASHROOM/PHE RENOVATION)
- iii. INTERIOR FURNISHING WORKS

TECHNICAL SPECIFICATION FOR CIVIL WORK

SPECIFICATIONS FOR HIGH PRESSURE LAMINATE (HPL):

| SPECIFICATIONS FOR HPL HIGH PRESSURE LAMINATES | | | | |
|---|---------------------|--|--|----------|
| <p>Supply and installation of 6mm thick Exterior grade F- Quality panels of standard size of one of the following: 1.3 x 2.8 m /1.854 x 2.8 m / 1.3 x 4.1 m / 1.854 x 4.1 m, with both side décor of HPL make or equivalent .The panels must be duromer high-pressure laminates (HPL) as per EN 438-6 type EDF with norm conformity as per EN 438-7 manufactured using NT Technology (Non-fading high performance acrylic polyurethane surface technology) conforming to norms with CE Mark. Panels are double hardened including acrylic polyurethane resin which is thermally cured under high pressure. The panel should have passed salt spray test for 24 hours, possess performance sustainability certificate for more than 25 years and proof of experience in handling similar type of work in India for more than 10 years. Material should be class B / class 1 complying with NBC 2016, ASTM E 84, BS 476 - 7</p> | | | | |
| <p>Installation of these panels must be done by MBE Rivets(with Fixed and Sliding Points) with minimum recommended Aluminum T section of 75x37x2 mm thick and L section 40x37x2.8mm thick held by Wall Bracket with Wind load and Dead load slot as per design, anchored by standard Hilti/Fischer or equivalent make anchor fasteners along with Thermal Separator.</p> | | | | |
| <p>Installation of the HPL Panels will be done using Rear Ventilated Principles only which is ensured by providing gaps of 20 mm at top and bottom(for free flow of air behind the façade) for the façade and using the framework with no horizontal section.</p> | | | | |
| <p>Silent Features</p> <ul style="list-style-type: none"> • Highly Weather Resistance • Optimally Lightfast • Dual Core • Scratch Resistant • Design Support (Application Engineerin • Impact Resistance • Warranty on Rivets (MBE Germany) • Complete System including Rivets , Profiles and FM HPL 10 Years warranty • Cost Saving 5 Sizes | | | | |
| PROPERTIES | UNIT | Test Method as per EN 438 Part 2 :2016 | Specied Values as per EN 438 Part 6:2016 | |
| Surface Quality (Dirt,Spots, etc.) | mm ² /m2 | EN 438-6, 5.2.4 | 2.0(max) | Complies |

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| | | | | |
|---|---------------------------------|--------------------|--|--|
| Thickness&maximum Variation | | | 2.0≤t≤3,0:±0,20 3.0≤t≤5,0:±0,30 5.0≤t≤8,0:±0,40 8.0≤t≤12,0:±0,50 12.0≤t≤16,0:±0,60 | 2.0 mm = ± 0.2 mm 4.0 mm = ± 0.3 mm 6.0 mm = ± 0.4 mm 8.0, 10.0 mm = ± 0.5 mm 12.0, 13.0 mm = ± 0.6 mm |
| Length & width | mm ² /m ² | EN 438-2-6,5,3 | 10mm/-0mm | 5mm / 0mm |
| Flatness | mm/M | EN 438-2-6 | 2.0≤t≤6,0,0:8.0 6,0≤t≤10,0:5.0 10.0≤t:3.0 | mm/m ≤ 2 |
| Edges Straightness | mm/M | EN 438-2-7 | 1.5(max) | ≤ 1.5 mm/m |
| Edges Squareness | mm/M | EN 438-2-8 | 1.5(max) | ≤ 1.5 mm/m as per EN 438-2, Clause no.8 |
| Density | g/cm ³ | EN ISO 1183-1 2004 | 1.35 | 1.44 |
| Dimensional stability at elevated temperature a) Longitudinal b) Transverse | % % | EN 438-2-17 | Lengthwise: ≤ 0.30 Crosswise: ≤ 0.60 | Lengthwise: 0.08 Crosswise: 0.16 |
| Mechanical Properties | | | | |
| Resistance to Wet Conditions, Increase in mass | EN 438-15 | | 8.0 (max) | 2 |
| Resistance to impact by Large Diameter ball Drop Height Diameter of indentation | EN 438-2-22 | mm | 10(max) | 5–6 |
| Flexural strength | EN ISO 178-2003 | Mpa | 80(min) | Crosswise: 105 Lengthwise: |

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| | | | | |
|--|-------------------|---|---|---|
| | | | | 170 |
| Flexural modulus | EN ISO 178-2003 | | 9000(min) | Crosswise: 11,000 Lengthwise: 16,000 |
| Thermal conductivity | EN ISO 12524-2000 | | No Requirement | 0.3 |
| Resistance to fixing (screw pull out strength) | ISO 13894-1;9 | N | 2000(min) | |
| Resistance to Climatic Shock a) Flexural strength Index b) Flexural Modulus Index | EN 438-2:19 | Rating Rating Rating | Appearance-4(min) Ds-0.80(min) Dm-0.80(min) | |
| Resistance to artificial Weathering Including. Light Fastness, after 650 MJ/m ² Radiant Exposure. (for Over 3000 Hours of Exposure) | EN 438-2-29 | Rating (after 3000 hours as per standard) | Grey Scale Contrast-3(min) Appearance-4(min) | Contrast: 4-5 Appearance: 5 |
| Resistance to UV Light, after 1500 Hours EN 438-2-28 | | Rating | Grey Scale Contrast-3(min) Appearance-4(min) | Contrast: 4-5 Appearance: 5 |
| Properties | Unit | Test Method | Specified Values | Clads Results |
| Fire Performance | | | | |
| Reaction to fire | EN 13501-1-2017 | Euro Class | 6.0mm-B-S2,d0 | B-S2,d0 |
| Surface spread of flame Flame Spread Index Smoke Development | ASTM E 84 | Class Index Index | A 0-25 200 | A 10 95 |
| Calorific Value | ISO 1716:2010 | MJ/Kg | 19.91(max) | 18-20 |
| ARCHITECT NARAYAN & ASSOCIATES PT LTD | | Signature of contractor/Authorized person with Rubber Stamp | | |
| Anti-bacterial Efficacy & Activity % Reduction in 24 Hours Activity after 24 Hours | JIS 2801-2012 | % Log Reduction | 95.0(min) 2.0(min) | 99.99 Exceeds |

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| | | | | |
|---|--|-------------|---------------------------------|------------------------|
| Anti-Fungus Efficacy Growth After 28 days | ASTM G-21-2015 | Class | 1 | 0(No Growth) |
| Corrosion Reistance | | | | |
| Resistance to Corrosion with 5% Sodium Chloride Spary | ASTM B 117 | Hours | 500 Minimum (Industry standard) | |
| Resistance to acid Rains (of 10% HC) | In House | Hours | None | |
| Properties | Unit | Test Method | Specied Values | Greenlam Clads Results |
| Sound insulation Characteristics in building & Building Elements | | | | |
| Sound Transmission Class (STC) | IS:9901(Part III)-1981 DIN:52210 Part 1-1981. ISO:10140(Part II/ASTM-E-90) | Class | No Specification | 30 |
| <p>Storage of panel on site: Storage of panel on site should be horizontally on a-at wooden Pallets with Cover</p> <p>Installation Installation with help LT Section which designed in build</p> <ul style="list-style-type: none"> • 40mmX37mmX2.8mm,and • 38mmX75mmX2.8mm (for area where two panel joining <p>Alu Brackets-Wind Load and Dead Load Brackets (4mm Thick) Rivets-MBE Rivets (German Made) Nut and Bolts- S S. (Fishers or Equivalent) Framing distance-maximum 600mm for façade and 450mm for soffit Gap between panels-minimum 6mm (horizontal & vertical both) Fasteners-standard Fasteners as per requirement Make Provides a warranty for the exterior grade compacts ("Product") for a period of 10 years.</p> | | | | |

1.1. General:

Scope of Work: The work contemplated under this contract includes General Builder's work for the aforesaid project, all as detailed in the Bill of Quantities, Specifications and to complete the said work in every respect in accordance with this contractor and with the directions and to the satisfaction of the Architect/ Consultant/ Owner/Employer.

Indian Standard Specification:

The particular Specifications for the work is as detailed hereinafter. These specifications shall be read in conjunction with the relevant Indian Standard Specifications and the obtainable as per local practice as detailed in various regional handbooks of practice and the work shall be executed accordingly. Where the specifications in any of the standards are at variance with the specifications detailed herein, the specifications herein shall govern.

Quality of Materials & General Standards of Work:

The contractor under this contract commits himself to use first class materials and assumes full responsibility for the quality of all material incorporated or brought for incorporation in the work. The work shall be executed in accordance with best engineering practice and as per direction of Architect/Consultant/Owner/ Employer.

Scaffolding:

All scaffolding and ladders required for the proper execution of the work shall be provided by the Contractor. The scaffolding should be stout and strong to prevent any collapse or displacement. Proper measure for safety of workmen working on scaffolding should be taken by the contractor.

Measurements: The mode of measurements, wherever possible is specifically mentioned in these documents, where it has not been mentioned, it shall be as per provision of the relevant Indian Standards. All the measuring tapes and other accessories necessary shall be provided by the contractor.

Tools and Plant: The contractor shall make all tools, plants and machinery necessary for execution of the works. He shall also arrange additional tools, plants and machinery as felt necessary by the Architect/Consultant time to time with no extra cost to owner. It is obligatory on the part of the contractor to arrange tools, plants & machinery at the work site in good and sound conditions, failing of which may constitute a breach of contract under the sole description of Architect/Consultant/Owner/ Employer.

Surveying and Staking: It is the express responsibility of the contractor to bring to site all surveying instruments if necessary for the marking out, fixation of levels, etc. and conduct these survey operations himself with utmost accuracy. The contractor shall put up stable bench marks etc. as necessary for the work. Architect/Consultant/ Owner/ Employer/his representative will be present when this work is being carried out and will inspect all these operations with the Contractor's assistance. The contractor shall be entirely responsible for accurate setting out of the work and he shall at his own expense make good any defects arising from errors in line and levels

Dewatering: Dewatering of accumulated water in all locations on job site from whatever source or cause until the virtual completion of the entire work shall be done by the contractor at his own expense and shall not be separately paid for. The rates quoted by the contractor shall be deemed to be inclusive of this.

Access to site, approach roads and roads within the premises, wherever required:

The contractor shall at his own cost provide all approach roads required for the purpose of carrying out the work in the most expeditious and efficient manner and shall remove the temporary roads on completion. He shall acquaint himself thoroughly regarding condition and suitability of public roads leading up to the limits of the premises and will provide vehicles for

transportation of materials which meet the requirements of these road conditions. It shall also be responsibility of the contractor to maintain at his own cost these roads till the construction is completed. The tenderer also acquainted himself with local laws and bylaws and complying with all police and highway authority requirements.

1.2 Earth Work:

Excavation:

Excavation for trenches over areas and for pits, etc. shall be done to widths, lines and levels as shown in drawings or to such lesser or greater widths lines and levels as directed. The bottom and side of excavation shall be trimmed to required side of excavation shall be trimmed to required levels, profile, etc. watered and thoroughly rammed. Where the contractor excavated below required level in good round inadvertently or carelessness, they shall make up the void in concrete (1:5:10) at his own expense. During excavation the contractor shall take necessary precaution to retain earth, so that the earth will not slide or fall down to avoid any accident and hamper the progress of work. They will take necessary step to prevent the damage the adjacent structure or existing services. They shall repair and make good any such damage at their own expense to the satisfaction of the owner. A suitable path for men and materials around the excavated pit should be maintained throughout the work.

Dewatering: All water which may get accumulated in excavations during the progress of work from whatever cause or source, shall bailed or pumped out as necessary. The rates for excavation shall be deemed to include for the same, if not otherwise specified.

Timbering to excavation (shoring): Where the soil is soft and sides of excavation needs supporting suitably designed planking and strutting shall be provided. The rates for excavation shall be deemed to include for all planking and strutting as necessary.

Refilling around foundations: Refilling around foundations shall be done with approved excavated materials. Refilling shall be done in layers not exceeding 30 cm thick, watered adequately and consolidated. The finished surface of filling shall be slightly proud to bring it to finished level after watering and consolidation as directed. The rates for refilling around foundations shall be deemed to include for this.

Disposal of Surplus excavated Materials: All materials considered surplus shall be removed to destinations and disposed off as directed. The disposal of the materials can be in any of the following ways as directed by the Architect/Consultant/Owner/Employer.

1. Filling in low lying areas
2. Filling in at places of filling such as under floors, in roads, etc.
3. Stacking of materials in pre-designated stacking yard.
4. Removal of material outside the plot for disposal.

Filling: Filling under floors or other places indicated shall be done with approved material obtained from excavation or approved materials brought from outside by the Contractor. The material should generally be of good quality. Filling shall be done in layers not exceeding 30 cm. thick and each layer shall be watered adequately and consolidated properly by 8 to 10 tones power rollers in the case of where floor is coming or pneumatic rammers where ever conditions permit. If it is not possible, the consolidation shall be done by hand rollers and

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pneumatic/hand rammers. The surface of the filling shall be finished to lines and levels as required. The filling shall be compacted in such a manner as to guarantee full stability. The compaction shall be such that minimum relative density obtained on testing is 90%. In general, test shall be performed for every 1000sqm of compacted area. The filling final level after consolidation/then cutting and ready to take up soling work under the floor item, shall be checked by Architect/Consultant/ Owner/Employer.

Measurement: Measurement for all excavation, filling, carting away and earth work shall be in solid measure. The rates quoted by the tenderers are thus for solid measure units. The following factors shall be applied to obtained quantities of solid measure.

| | | |
|-------------------------------|---|--|
| Excavation | : | No reduction in volume |
| Filling watered and | : | Volume shall be determined by levels consolidated in layers levels taken before and after compacted filling and by measuring the length and breadth as required. |
| Loose measure (as in trucks): | : | Volume of loose measure less or dumping's 25% or as per I.S. code of practice. |

The mode of measurement for various type of excavations shall be as under:

- a) In case of trenches, pits and areas, measurements shall be on the basis of width of foundation & the depth of bottom of foundation (bottom of bed concrete if provided) formation. Surface dressing shall be measured in plan projection only.
- b) In case of pipe trenches and drains, measurement of width of trench shall be diameter of the pipe plus an allowance of 50 cm. to allow for collars, flanges etc.
- c) Excavation in rock shall be measured up to levels indicated or required. No undulations as physically appearing after excavation shall be taken into consideration while arriving at the quantities. The rates quoted by the contractor shall be deemed to include for this and no extra is admissible.

Sub-grade Conditions: When no data is available of soil formation and depth of water level of propose works site the contractor should make his own arrangements of preliminary site investigation by actual inspection of the site and surrounding areas to assess the nature of soil and to foresee the difficulties that may arise during construction period. The contractor shall acquaint himself of the above before filling up of the tender.

No claim whatsoever will be entertained on any account of conducting these exploratory works or lack of investigation on the part of the Contractor.

Brick Soling: Where brick soling is required to be provided, it shall conform to the following specifications:

It shall either be flat or be laid on edge of the bricks touching each other as per item. Soling where specified in two layers, the line of joints in the bottom layer shall cross those in the top layer. Soling shall be closely packed leaving no interstices or gaps. The interstices to be filled with fine sand and shall be sprayed with water. If cavities appeared between two bricks after spraying with water it shall be mended again by spreading fine sand. Where ever floor con-

crete is coming on soling, building paper (polythene sheets) is to be laid to receive the concrete.

Controlled Concrete, Plain & Reinforced Concrete:

General: Concrete and reinforced concrete work shall be carried out generally in conformity with the latest Indian Standards IS:456 except for provisions indicated here in below. All work is to be carried out with utmost precision and up to-date scientific know-how and the contractor shall employ thoroughly competent staff to achieve the highest standards.

Cement: Cement for the work shall be ordinary PPC conforming to the latest Indian Standards and of the best normal setting quality unless a quick setting quality is expressly instructed in the specifications or otherwise during the course of the work by Architect/Consultant/Owner/ Employer. If directed the contractor shall purchase PPC cement as fresh as possible after manufacture and where there is reason to believe the cement has been long stored, Architect / Consultant / Owner / Employer may demand a Laboratory Test Certificate regarding the character of cement and the contractor shall furnish the same at no extra cost. Architect/Consultant/ Owner/Employer shall reject any cement which in its opinion does not meet the required standards contractor shall consider in his rates during quotation that cement supplied by Client, has to be tested either from engineering College or any professional laboratory to have a judgment on Quality of Cement.

All bags and containers in which cement is packed shall be stored in a dry, weather-tight, properly ventilated structure with adequate provision for prevention and absorption of moisture. The contractor shall at all times maintain for the inspection of Architect/Consultant/Owner/Employer a log book indicating the receipt of cement, brand and agent from whom obtained and the age of cement. Cement which has caked or perished by being wet or otherwise, shall on no account be used on the work.

Cement shall be consumed on the works in the same sequence as that of their receipt at site. Cement reclaimed from cleaning of bags or from spillage from containers or otherwise shall on no account be used.

Sand: Fine aggregate shall generally conform to latest Indian Standards (IS:383). Sand shall be natural sand, crushed gravel sand or crushed stone sand at the discretion of the Contractor. Use of sea sand is prohibited. It shall be composed of hard siliceous material and shall be clean and of sharp angular grit type. Sand shall be properly graded minimizing all voids.

Allowance for bulking of sand shall be made. Silt content on sand should not be more than 5% Laboratory equipment such as measuring jars etc. are to be kept at site for time to time checking of bulkage and silt content.

Coarse Aggregate: Coarse aggregate shall be approved hard aggregate generally conforming to latest Indian Standards.

Aggregate, Gradation, Storage, etc.: Aggregates shall be stock piled properly and separately on the basis of gradation indicated herein below.

| | | |
|--------|---|------------------------------|
| Fine | : | 0 to 3 mm (1/8" and down) |
| Medium | : | 3 to 7mm (1/8" to 5/16") |
| Coarse | : | 7 to 30 mm (5/16" to 1.1/4") |

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Aggregates shall be clean and shall not contain any foreign matter, silt, loose or destructive substances, harmful chemicals, etc.

Aggregates shall be stored in proper bins which shall have good drainage to prevent the inclusion of foreign matter and preserve the gradation. Sufficient live storage shall be maintained to permit segregation of successive shipment, placing of concrete at the required rate and such procedures as inspection and testing.

If directed, the aggregates shall be washed before use. The grading of aggregates for use on works shall be as per the Indian Standards.

Proper sieve analysis shall be carried out to determine the best gradation obtainable from the available aggregates. The sieve analysis shall be performed as per standard practice and as laid out in the relevant Indian Standards.

A complete set of standard sieve shall be provided by the Contractor at the Construction site at all times. The graphs in connection with the sieve analysis and the standards of approvals for the aggregates shall be as per Indian Standards.

Water: Water for all concrete work shall be clean, free from deleterious matter such as oils, acids, alkalis, sugar and vegetable matter. Every attempt shall be made to use water which is fit for drinking purposes. Water storage facilities provided by the contractor shall be maintained properly to preclude contamination of water by any of the harmful substances. The quantity of water to be added to concrete for mixing shall be such as to afford workability consistent with strength. Water/cement ratio shall be recorded in every batch of concrete.

Arrangement for slump cone test shall be kept at site to arrive workability whenever the Architect/Consultant/Owner/Employer wants to check at site.

Tests for determination of strength of concrete: As will be apparent from the Bill of Quantities, the strength of concrete specified is the criterion and the contractor shall make every effort to obtain the specified strengths by good quality control. In case of concrete which does not obtain the specified strength at 28 days. Such work shall be demolished and reconstructed to obtain the requisite strengths all as directed by Architect / Consultant / Owner / Employer. To determine whether concrete in any particular part of the work is of the requisite strength or not, test cubes (works test cubes) shall be made from samples collected from the concrete being poured for the particular part and determined as per acceptance criteria detailed hereinafter. The salient features for the collection of samples is as indicated below.

Testing of Concrete Cubes for determining Compression Strength:

1. Quality As specified
2. Compression strength shall be as specified for the particular type of concrete.
3. Criteria for acceptance of work.

Part or element of concrete work shall be deemed to be acceptable, provided the three cubes tested for 28 days strength conform to the following:

- a) Average of the three cubes strengths shall not be less than the specified strength.

- b) No individual cube strength shall be less than 90% of the specified strength.
- c) If any individual cube strength exhibits more than 133% of the specified strength, such cube shall be classified as freak and criteria in (a) and (b) above, shall be applied for the remaining two cubes only and the acceptability determined.

4. Quantum of cubes and testing

A set of 6 cubes shall be cast per every 50 M3 of concrete. OR A set of cubes on every day of concreting. OR A set of 6 cubes on every important element as decided by Architect / Consultant / Owner / Employer of the work. The decision of Architect/Consultant/Owner/Employer in this regard shall be final and binding.

Batching and making of concrete: All batching of aggregates and cement shall be by volumes. All the necessary equipment such as measuring boxes, devices for determination of moisture and bulk in sand, slump cone etc. shall be provided by the contractor. Concrete shall be machine mixed until there is a uniform distribution of materials and uniform color and consistence is achieved and under no circumstances for less than two minutes.

A wooden board approximately 30 CMS. x 40 CMS shall be put up at the concrete mixer on which shall have been legibly written English and the social language, the quality of concrete that is being mixed, the proportions and other relevant data.

Slump: If in the opinion of Consultant, slump cone tests are required to be performed to establish workability the same shall be carried out free of cost. Slump tests are however, to serve as guide only.

Form Work: Generally, all the concrete surfaces are intended to be plastered. Form work shall be properly designed and constructed such that it is rigid enough to remain free from bulging, sagging or replacement during placing of concrete. It should also be so constructed as to facilitate removal of the same without damage to concrete. The form work shall be adequately watertight to prevent any loss of liquid. All form work shall be accurately erected in regard to size, levels etc. In case of timber form work, the surface of forms in contact with concrete surfaces shall be wrought. The joints between boards shall be close fitting and very thin for the concrete surfaces designed to have exposed finish and not intended to be plastered. All form work shall be properly cleaned before any concreting is carried out.

Surface of forms coming in contact with concrete shall be treated with approved form emulsions. It shall be ensured that these emulsions do not stain or discolor the natural color of concrete.

All form work shall be removed as per latest IS:456. Form work shall be removed without shock or vibration. Edges of beams and columns if required to have chamfers shall be obtained by suitably fixing triangular edge beads 20 mm x 20 mm. to the forms. (No extra is admissible to the contractor on account of these incidental and minor works for sizes up to and including 20 mm x 20 mm). Likewise, where drip notches are necessary, they should be formed by suitably shaped fillets nailed in forms.

Form work for all beams and other horizontal construction members shall be built to an upward camber of 1/300" of the span (in the center) to nullify the effects of optical illusion. The

Camber shall be in addition to such camber as may be required and shown in the Static Calculations.

Transporting and Pouring of Concrete: No mixing of concrete shall be started unless the situation where they are to be poured are prepared and kept ready. Concrete shall be poured immediately on preparation. Transporting of concrete shall be done as speedily as possible and also in a manner to prevent segregation of aggregates. No retempered concrete shall be allowed to be used on the works. No concrete shall be allowed fall through a height more than 1.20 M. where the concrete to be placed from more height it should be done through chute as directed by Architect/ Consultant/Owner/Employer.

Lift of concreting shall normally be not greater than 2.00 M in height.

Before fresh concrete is placed against an already cast and hardened section, such surfaces shall be roughened, swept clean, moistened with water and treated with cement slurry. Fresh concrete shall than be poured as required. Under no circumstances, concrete mixed more than 20 minutes shall be used where initial setting has commenced. Dewatering of excavations for concreting where necessary shall be carried out by the contractor as directed and the rates quoted by the contractor are deemed to be inclusive of such dewatering. No concreting shall be done in adverse weather condition without proper precautions or approval from consultant. Where materials are to be mixed by hand mixing as per requirement it is desirable to use 10% more cement that that of machine mixing.

Consolidation and Processing of Concrete:

Concrete for all works shall be compacted by means of suitable vibrating equipment. One or more spare vibrators which are in complete working condition shall always be kept ready at sites to be put into commission in case of failure of the vibrators under use. The vibrators shall be operated by skilled personnel, thoroughly instructed as regards the mode, frequency, duration etc. regarding vibration. Concrete of low quality may however be permitted by Architect/Consultant/Owner/Employer to be consolidated by hand only after prior permission.

Finish to Concrete Surfaces:

Finish to concrete surfaces at various situations shall be as per directions of Architect/Consultant/Owner/Employer. Where form finish is specified, the final surface shall be smooth and even and no-undulations, ridges, spots etc. shall be permitted. They shall be laid to pattern as directed. In case surfaces intended and directed for form finish, exhibit any of the defects above mentioned, the surfaces shall be rubbed with carborundum or plastered and finished as directed at the risk and cost of the contractor. The decision as to the acceptability or otherwise of a surface will be notified by Consultant and the contractor will implement the instructions accordingly.

Concrete cover for reinforcement:

Concrete cover for the reinforcement shall be as per the latest Indian Standards and as per directions at site from time to time proper concrete cover blocks to suit various covers as required shall be provided in adequate numbers sufficiently ahead of the work.

Construction joints:

Construction joints in concrete work shall be provided as far as possible only at predetermined places in consultation with Architect/Consultant/ Owner/ Employer. Joints shall be provided as specified in latest Indian Standards or as directed by Consultant.

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Curing:

It is very important that all cement concrete work shall be cured properly. All concrete work shall be kept continuously in a damp or wet condition by pouring or by covering with a layer of moist sack, canvas, hessian or similar material for a period of seven days at least from the date of concreting. Water used for curing shall also be free from any deleterious substances and shall generally be fit for drinking. The work shall be adequately protected from drying, winds and direct sun rays. The contractor should arrange at his own cost a temporary water supply line with provision of centrifugal pump valves etc. for curing and constructional purpose at higher level. A sample sketch is enclosed for the reference purpose.

Stop cooks with spray nozzles with an interval of 12m are to be put in ring main.

Opening and inserts:

All opening and inserts which are designated in due time or as required for services, will be exactly provided by the contractor including supply of materials. The contractor should also fix the anchors or such items which may be supplied by the proprietor in exact position and in perfect lines and levels. Inserts apply to such items as timber, dowels, bolts, loop, brackets, suspension irons, hooks, screws, plates, pipe of various types and diameter etc. Openings in concrete or masonry must be provided in exact location to correct shape, size and depth or slightly bigger, if directed so, as shown in drawings or as instructed. It must be clearly understood that the provisions of inserts and openings as contemplated in this contract are to be carried out with "utmost precision" and any deviation of the same from that as shown in drawing or instructed have to be rectified by the contractor at his own cost and responsibility. The contractor should make provision of openings to deep beams and their members at bottom or at lower level as necessary for cleaning purpose prior to concreting.

Ready Mixed Concrete (RMC)(IS: 4926-2003)

Concrete Mix Information to be supplied by the purchase:

RMC: _____

Contractor: _____

Site: _____

| | |
|---|--|
| MIX CODE | |
| Grade (N/ sqmm) (Characteristic strength) | |
| Minimum Cement content (Kg/ cum) | |
| Mineral additives (Pulverized fuel ash/slag others (Kg per cum) | |
| Maximum free water cement ratio | |
| Nominal maximum size of aggregate | |
| Cement type and grade | |
| Target workability (slump in mm) | |
| Target workability at site | |
| Maximum temperature of concrete at the time of placing | |
| Class of sulphate resistance (if applicable) | |
| Exposure condition if applicable | |
| Class of finish if applicable | |
| Mix application | |
| Method of placing | |
| Any other requirement | |
| Concrete testing | |

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| | |
|---|--|
| Material testing (any none routine requirement) | |
| Alternatives to be offered (yes.NO) | |
| Method of curing to be used by contractor | |
| Quantity | |

DELIVERY TICKET INFORMATION:

The following information shall be included in the delivery ticket to accompany the load to the purchaser:

- a. Name or number of the ready mixed concrete depot
 - b. serial number of the ticket
 - c. date:
 - d. Truck number
 - e. Name of purchaser:
 - f. Name and location of site,
 - g. Grade or mix description of the concrete
 - h. Minimum cement content (if specified)
 - i. specified target workability,
 - j. Minimum cement content,
 - k. type of cement and grade
 - l. maximum free water -cement ratio
 - m. nominal maximum size of aggregate,
 - p. General type or name of any chemical and mineral admixtures included
 - q. quantity of concrete in cum
 - r. time of loading,
 - s. signature of plant operator,
- a statement warning the purchaser of the precautions needed to be taken when working with cement and wet concrete

Following information on site shall be added;

- a. Time of arrival, on-site,
- b. Time when discharge was completed,
- c. Any water/admixtures added by the supplier to meet the specified workability,
- d. Any extra water/admixture added at the request of the purchaser of the concrete or his representative, and his signature,
- e. Pouring location.
- f. Signature of the purchaser or his representative conforming discharge of the load.

Tor Steel Reinforcement: FE 500D and above (SAIL/TATA/JINDAL/VIZAG STEEL)

All M.S. reinforcement for concrete work shall conform strictly to the latest Indian Standards (IS:432 - part I & II). They shall be of tested quality with a permissible stress value of 1400 Kg. Sqcm. High yield strength Ribbed Tor steel of cold twisted steel for reinforcement shall be of tested quality and shall conform to the relevant Indian Standards (IS:1786). Reinforcement shall be fabricated to shapes and dimensions shown on the drawing and shall be placed where indicated on the drawings or required to carry out the intent of drawing and specifications or as directed by Architect/Consultant/Owner/Employer. Before placing, reinforcement shall be thoroughly cleaned of loose rust, coating etc. which would result in reducing or destroying the bend. Oiling the bars to clean them is strictly prohibited. Bending, straightening, cutting etc. operations shall be carried out in a manner not injurious to the material.

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All reinforcement shall be bent cold. Unless otherwise directed, reinforcement shall not be spliced at points of maximum stresses. Architect/Consultant/ Owner/Employer shall be informed of the same before such splicing is taken up. Laps and splicing shall conform to the latest Indian Standards.

Reinforcement shall be accurately tied at all intersections and laps with 16 SWG soft drawn binding wire, such that the reinforcement will give a rigid structure. Binding wire will not be measured or accounted for separately. The contractor's rate for reinforcement will be measured and paid for according to bending lists without allowances for cutting, wastage, binding wire etc. Authorized laps, hooks, chairs, spacers etc. shall however be accounted for in case, the contractor or Architect/Consultant/Owner/Employer desires to resort to welding or swivel nuts, there shall however be made as if the laps have been provided and no extra claim whatsoever shall be admissible on this account.

Reinforcement shall be assembled in place with proper concrete cover blocks to suit various covers as required.

Measurements:

All measurements shall be as given below or where not given as per latest IS : 1200 Concrete will be compensated for according to its actual volume.

The computation will be based upon the construction plans only and no site measurements shall be taken for this purpose. All incidental work stated in the Technical Specifications and also dewatering at the time of concreting are deemed to have been included for in the unit prices quoted by the contractor. Openings with an area larger than 0.1 sqm shall be deducted from concrete quantity and where openings are smaller, these shall not be deducted.

Form work will be measured and paid for according to their contact area. The unit prices of the forms incorporate all scaffolds, nails, clamps and all incidental work. Openings with an area larger than 2 M2 shall be deducted from form work quantities and the form work required for sides of such openings shall be paid for. Openings of less than 1 Sqm. area shall not be deducted from form work quantities and no allowance for form work for sides of such openings shall be made.

Reinforcement steel will be compensated for according to the approved bending lists without allowances for cutting, rolling margin and waste. Binding wire, cover blocks etc. will not be measured or paid for separately. The contractor shall prepare the **Bar Bending Schedules** and incorporate the same on the reinforcement drawings all as directed and submit it to Architect/Consultant/ Employer for approval.

All openings and inserts which are indicated in drawings and as per requirements for services shall be provided at exact positions and no payments shall be made for providing or fixing these. Only such openings or inserts which have not been indicated earlier or such additional openings/inserts required especially due to changes made by Architect/Consultant/Owner/Employer shall be paid for.

Excepting for the above, all other measurements shall be as per stipulations under the latest Indian Standards Mode of Measurements for Building Works.

1.4 MASONRY:

Materials:

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All bricks shall be fly ash bricks of locally available good quality quality. They shall be hard sound and well burnt with sharp edges and of uniform sizes and shapes. Bricks shall be neither under burnt nor over burnt and shall be free from cracks, stone floats, or other such defects.

When immersed in water for 24 hours, bricks shall not absorb more water than 20% of its dry weight. All bricks shall be identical/ equal to samples submitted and approved by Company before the commencement of the work. Crushing strength of bricks shall not be less than 35 Kg. Sq.cm. Metallic sound of brick is also a criterion for quality.

Cement and Sand:

Cement and sand used for masonry and plastering work shall confirm to the specifications laid down "Plain and Reinforced Concrete".

Additives:

Additives, like integral water proofing compounds, shall be of the approved type from reputed manufactures. These shall be used strictly in accordance with the manufacturer's instructions/specifications. The additives shall conform to IS: 9103.

Samples:

When demanded by Architect/Consultant/Owner/Employer, the Contractor shall produce samples of materials or carry out samples of work for Company's approval. All materials used as also works carried out shall conform, to the quality of approved samples. Production of these samples shall be at Contractor's cost.

Brick masonry:

Brick shall be soaked in clear water for at least six hours in a vat before use. The average water absorption of brick after immersion in water shall not be more than 20% by weight. Bricks shall be laid in English bond unless specified otherwise. No half or quarter brick shall be used except as closures. Brick shall be accurately raised to plumb.

Brick work shall be raised uniform all round and no part shall be raised more than 1 meter above another at any time, and the work shall be properly toothed and racked back.

In case of 11.5 cm. thick brick walls, hoop iron reinforcement 25mm x 12 to 16 gauge or wire netting reinforcement shall be provided in every fourth course. The reinforcement shall be properly bedded in mortar, properly lagged etc. all as directed.

The contractor will have to build in holdfast and such other fittings in brick work without extra cost.

Joints in brick work shall not be more than 10mm thick. Brick work shall not be raised more than 10 to 12 courses a day. The work shall be kept watered thrice a day for 10 days and afterwards twice a day for 3 weeks. All joints shall be thoroughly flushed with mortar at every course. Care shall be taken to see that bricks are properly bedded and all vertical joints completely filled to the full depth. The jointed of brick work shall be raised out to a depth not less than 10mm. as the work proceeds. The surface of brick work shall be cleaned down and watered properly before the mortar sets.

Construction joints are to be provided at an interval of 30 m in the case of boundary wall or where the length of brick wall is long.

The contractor shall also make or leave holes recesses as required and fill in the same at a later date as directed at no extra cost.

Measurements:

1. General

All the rates quoted by the Contractor shall be for a fully finished item of work and shall include for all material, labour, miscellaneous works like storage, loading/unloading, scaffolding, hoisting gear etc. as also all taxes, duties, overhead, profits, etc.

2. Masonry

Accounts on masonry shall be settled on the basis of cubic meters or square meters as indicated in the Bill of Quantities. Quantities will be decided on the basis of pertinent plans. Openings and recesses which exceed 0.10 cum. will be deducted from quantities. Openings left initially on specific instructions or as required shall be closed at a later date, if so, instructed by Consultant, at no extra cost. Similarly, all openings, recesses, grooves etc. shall be provided at no extra cost. All materials supplied by Clients shall be fixed in masonry free of charge.

Lintels above door/window openings, for openings up to 100 cm. clear width shall be treated as part of masonry and the cost therefor shall be settled in the same manner as for masonry, irrespective of what material these lintels are made of. For openings of larger than 100cm. clear width, however, lintels shall be paid for under relevant items and due deduction shall be made in masonry.

1.5 Damp proof Course (D.P.C.):

Damp proof course shall be provided over all walls as directed. Concrete for damp proof course shall be of M-20 grade, as defined under "Concrete" section and shall be 5 cm. thick or as specified in bill of quantities and to the full width of the wall. An integral waterproofing compound shall be provided in the concrete in the proportion specified by manufacturer. The rate quoted for D.P.C. shall be inclusive of the integral waterproofing compound as also for shuttering required. The waterproofing cement additive shall comply IS:2645.

SPECIFICATIONS FOR MARBLE/ STONE FLOORING AND CLADDING

1.0 MARBLE / STONE SLAB:

1.1 The color and quality of the marble / granite slabs shall be of the kind of marble / granite specified in items/drawings/as directed by the architects. The marble from which the slabs are made shall be of selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. Before starting the work, the contractor shall get the samples of marble slabs approved by the architects and Employer. All slabs which go into work shall strictly conform to the samples, failing to which the entire materials are likely to be rejected.

1.2 The slabs shall be machine polished and machine cut to the dimensions specified

in items of the schedules of quantities/drawings and as directed by the Architects.

2.0 DRESSING OF SLAB:

- 2.1 Every stone shall be cut to the required size and shape, fine dressed on all sides to the full depth so that a straight edge laid along the side of the stone is full in contact with it. The top surface shall also be fine dressed to remove all waviness. The top surface of the slabs shall be machine polished and exposed edges machine cut, or as specified in the item and as directed by the architects. All visible angles and edges of the slabs shall be true, square or as required, and free from chippings and the surface shall be true and plain. Size of the stone to be used for various items shall be as mentioned in the schedule of quantities/drawings. Marble stones of approved smaller sizes other than mentioned in the schedule of quantities, if required for bands, borders, flooring etc. shall be laid as directed by the architects.
- 2.3 Any opening of required size and shape at any desired place in flooring, bands, borders etc. shall be made in such a way that marble bounded by number of marble stones/slabs. No broken or defaced stone ` permitted in the work.

3.0 BEDDING/ BACKING MORTAR:

- 3.1 The bedding/backing shall be of cement mortar/lime mortar of mix and thickness as specified in the description of the item.
- 3.1.1 Mixing: The mixing of mortar shall be done in mechanical mixer or hand mixing as specified/as directed by the architects.
- 3.1.1.1 Mixing in Mechanical Mixer: Cement and sand in the specified proportion shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste.
- 3.1.1.2 Only the quantity of mortar, which can be used within 30 minutes of its mixing, shall be prepared at a time.
- 3.1.1.3 Mixer shall be cleaned with water each time, before suspending the work.
- 3.1.2 Hand mixing: If approved by architects, hand mixing shall be allowed. The measured quantity of sand shall be leveled on clean masonry platform and cement bags emptied on top. In hand mixing, the quantity of cement shall be increased by 5% over the approved contrast, with no extra cost to the department.
- The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture gives a uniform color. The quantity or dry mix which can be used within 30 minutes shall then be mixed on masonry through with just enough quantity of water to bring the mortar to the consistency of stiff paste.
- 3.1.3 General: Mortar shall be used as soon as possible after mixing and before it has begun to set, and in case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work immediately.

4.0 LAYING-FLOORING:

- 4.1 Before laying the cement mortar bedding/backing, the concrete/brick, floor/wall surfaces shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc., brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Until and unless the surface is approved by the architects, the flooring shall be laid evenly and to the required slopes as directed/specified. The marble slabs shall be thoroughly washed and cleaned and

then laid on the bedding/ backing with cement floating at the rate of 4.39 Kg. / sq.m. All slabs shall be truly and evenly set in a thick cement slurry or paste like consistency applied to the sides and bottom and over the prepared base. The slabs shall then be tamped down with a wooden mallet until they are exactly in true plane and line with adjacent slabs. All slabs shall be extended upto the unplastered surface of masonry walls/RCC columns/RCC walls. The slabs shall be close jointed in matching as shown in drawing.from various rooms to the corridors. No change of lines shall be permitted at junction between rooms and corridor, if the same flooring is specified in both the places.

5.0 MARBLE / STONE SILLS, TREADS ETC.:

5.1 Marble stone for sills shall be of approved quality. Dressing of stone slab, mortar mix. For bedding/backing, laying etc. shall be similar to as described above as far as applicable. Marble slabs of specified thickness and width shall only be provided. The length of the each slab required for the sill shall be of the pattern which shall coincide with the lines of the mullions of windows where it is laid or as directed by the architects. Normally it shall not be less than 1.0 m. length.

6.0 MARBLE / STONE CLADDING

Only machine cut and machine polished marble stone will be used. Brass cramps and brass pins of approved quality, size and make shall be provided. The brass pins shall

be provided at the meeting of two marble slabs both ways horizontally and vertically. The brass cramps shall be provided at the places approved by the architects. Marble to be used shall be of approved size, colour, type of veins and laid as specified in schedule of quantities or to the pattern shown in drawings or as directed by the Architects. Laying of marble stone shall be similar as stated above as far as applicable

7.0 POLISHING AND FINISHING

7.1 The polishing and finishing shall be carried out in the similar manner as specified under the chapter "TERRAZZO/CEMENT TILES FLOORING, SKIRTING/DADO ETC." as far as it is applicable.

8.0 MEASUREMENT

8.1 Marble stone flooring, sills, treads, risers, dado cladding etc. shall be measured in square meter correct to two places of decimal. The length and breadth shall be measured between the finished faces correct to two places of decimal of meter. No deduction shall be made nor extra paid for any opening of area upto 0.05 sq.m. Nothing extra shall be paid for working at different levels.

NOTE: Wastage in marble slab cutting to get the required dimensions, as specified in drawing or as directed by the Architects shall be deemed to be considered by the contractor while quoting the rate for work. The work shall be measured as above and no extra claim will be entertained on this account

9.0 **RATE:** The rate shall include the cost of all materials, transport tools, plants, scaffolding and labour involved in all operations described above.

10.0 GRANITE STONE FLOORING, TREADS, RISERS, SILLS, CLADDING ETC

10.1 The specifications mentioned for Marble stone flooring shall be generally applicable for this item. In case of granite stones available in different shades, the samples shall be submitted for approval of Architects and Employer.

SPECIFICATIONS FOR VITRIFIED TILE FLOORING, DADO/ SKIRTING/ FACIA

1.0 MATERIALS

Vitrified Tiles: The tiles shall be of approved make generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under:

The tiles shall be square or rectangular of nominal sizes such as: specified In Schedule of quantities / drawings or as directed by the Architect & Employer. Thickness shall be as per recommendations of the approved manufacturers.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES

- 1 Deviation in length (+/-) 0.6%
- 2 Straightness of sides (+/-) 0.5%
- 3 Rectangularity (+/-) 0.6%
- 4 Surface flatness (+/-) 0.5%
- 5 Water absorption < 0.50%
- 6 Mohs. hardness > 6
- 7 Flexural strength > 27 N / mm
- 8 Abrasion resistance < 204 mm
- 9 Skid resistance (friction coefficient) > 0.4
- 10 Glossiness Min. 85% reflection

The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Architects and Employer before bulk procurement for incorporation in the work

2.0 PREPARATION OF SURFACE FOR FLOORING

Following procedure shall be followed

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped as specified for marble tile Mortar and bedding: Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials; preparations etc. as specified under cement mortar.

All necessary activities, measures and surface dressing required as per site condition to be taken up/arranged by the Composite Contractor to prepare the old surface for fixing new tiles in the floor.

The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt,

scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope. Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1sq.m. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set.

3.0 LAYING OF TILES FOR FLOORING:

The tiling work shall be done as per the pattern shown in the drawing or as directed by the Architects. As a general practice laying of tiles shall be commenced from the centre of the area and advanced towards the walls. Cut tiles, if any, shall be laid along wall with necessary border pattern as shown / directed by the Engineer-in Charge. Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. White cement slurry to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1.00 mm. in width. The joint shall be grouted with white / matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with putty/POP and allowed undisturbed for 14 days, to avoid stains/scratches in the newly prepared flooring.

4.0 Tile on Tile Application Detail - Non-Skid Adhesive (NSA)

CEMENTITIOUS POLYMER MODIFIED TILE ADHESIVE

Description

Roff Non-Skid Adhesive is a blended polymer modified cement based powder tile adhesive. It gives excellent bonds on cementitious surfaces like, concrete, plaster, etc. Roff Non-Skid Adhesive forms a waterproof barrier between two surfaces and has excellent 'grab' properties. This is an ideal product for Tile-on-Tile applications.

Areas of Application

For fixing all types of tiles on internal wall/floor, external floor & tile on tile applications.

Features & Benefits

- a. Ready to use, needs only mixing with water

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- b. Excellent adhesion, low shrinkage
- c. Suitable for indoor and tile on tile applications
- d. Sufficiently flexible to accommodate physical & thermal movements
- e. Needs no curing, needs no hacking or mechanical key on the surfaces
- f. Floors can be used after 24 hours
- g. Soaking of tiles & backing of surface not required

Method of Application

- a. The surface to be tiled should be sound and thoroughly cleaned. Old surface should be free from wax, grease, polish etc.
- b. Add 3 to 3.5 parts of Roff NSA Powder to 1 part of water. At site, addition of water shall be adjusted to attain desired consistency. Do not put water into the powder. Mix with a trowel / slow speed drills (50 - 100 rpm) until a lump free homogeneous paste is obtained.
- c. Always mix the required quantity, which can be consumed within the prescribed pot life adopting the mixing proportion mentioned above.
- d. Leave the mixture for 5 min. before using.
- e. Spread the adhesive to a thickness of approx. 3-6 mm and comb with a notched trowel. Strictly apply the adhesive paste which can be tiled with in 10 to 15 mins.
- f. Intermittently touch the adhesive paste on substrate by finger. If the adhesive sticks to fingers then continue tiling and if not scrape off the adhesive and apply new coat.
- g. Start placing the tiles on the surface to be tiled. Tap the tiles properly to ensure complete coverage of the backside of tiles and to eliminate the possibility of any air voids.
- h. Keep joints between two-tiles using Tile Spacers
- i. Allow tiling to set for 24 hours and start filling joints next day with Roff Rainbow Tile Mate.
- j. After grouting clean and polish tiles with a damp sponge or cloth. To remove Hard Stains use roff, cera clean.

Precautions & Limitations

- a. Always add powder to water and not water to powder.
- b. Do not add more water than recommended.
- c. Do not add sand or cement at site.
- d. Before doing tile-on-tile application, ensure that the original tiling surface is in sound condition.
- e. In case of undulations in the existing floor, rectify the same before applying Roff Non-Skid Adhesive.
- f. Strictly not recommended for the direct use on gypsum plaster, paint, wood & metal.

T02 Non-Skid Adhesive (NSA)
CEMENTITIOUS POLYMER MODIFIED TILE ADHESIVE

Technical Information

| | | |
|--------------------------|---|-------------------------------|
| Appearance | : | Cement Grey Powder |
| Mix ratio | : | Approx. 3 - 3.5 : 1 (by vol.) |
| Open time | : | Approx. 10 - 15 |
| minutes at 30°C Pot life | : | approx. 60 - 90 |
| min. at | | |

TECHNICAL SPECIFICATIONS: 12 / 93

Coverage : 7 - 7.5 Sq. mtr. / 30 Kg Bag at 3 mm thickness
3 - 3.5 Sq. mtr. / 30 Kg Bag at 6 mm thickness

Self Life : 12 months pack sealed and stored in damp proof conditions

5.0 FIXING TILES FOR DADO & SKIRTING / FACIA:

The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed:

The back of tiles shall be cleaned off and covered with layer of approved adhesive like BAL-ENDURA or equivalent with proper troweling as per manufacturer's recommendations

The edges of the tiles shall be smeared with the adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1.00 mm. in width. The joint shall be grouted with approved adhesive. The joints shall be kept in straight line or as per the approved pattern. While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows or other openings are located within the dado area, the corners sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

6.0 GROUTING OF JOINTS IN FLOOR / SKIRTING / DADO:

The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like BAL-ENDURA or equivalent grouts. After finishing the grouting process, after 15 minutes, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

7.0 CLEANING:

As directed by the Architects, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has been set, the floor shall be carefully washed clean and dried. While drying the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

8.0 MODE OF MEASUREMENT AND RATE:

Dado/ flooring/ skirting shall be measured in sq.m correct to two places of decimal. Length and breadth shall be measured correct to 1 cm. between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area up to 0.1 sq.m. The rate shall include all the cost of labour and materials involved.

9.0 CLEANING AGENTS FOR VITRIFIED TILES:

Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

STAINS CLEANING AGENT

Robin Blue Household detergent / Warm water Marker ink Turpentine / Acetone / Trichloroethylene Pen ink Acetone / Isopropyl alcohol

Methylene blue Isopropyl alcohol / Acetone

Sauce Ammonia solution

Cement Turpentine / Acetone / Trichloroethylene / Conc. HC Tea Hydrochloric acid / Bleaching powder

Coffee Sodium hydroxide / Potassium hydroxide Beer Sodium hydroxide / Potassium hydroxide Diesel Acetone / Petrol

Lab indicator Acetone / Isopropyl alcohol Cement and grouting Hydrochloric acid

Pencil mark Benzene or Toluene or Xylene

Plaster of Paris (POP) Ammonium sulphate solution

Iodine (Tincture iodine) Sodium hydroxide / Potassium hydroxide

Hair dye per chloric acid

Paan Lemon juice or citric acid

Marker pen Acetone

SPECIFICATIONS FOR WATER-PROOFING IN WET AREAS

1.0 PREPARATION OF SURFACE FOR FLOORING

Following procedure shall be followed:

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped as specified for vitrified tile.

The surface shall be cleaned thoroughly and all cracks shall be filled up with polymer modified mortar using Dr. Fixit Pidicrete URP or approved make.

Angle fillets

75x75mm shall be prepared in sand cement mortar (1:4) admixed with integral waterproofing compound Dr. Fixit LW+ or approved equal @ 200ml per bag of cement.

2.0 APPLICATION OF MEMBRANE BASED WATER-PROOFING FOR FLOORING

Following procedure shall be followed:

A membrane based waterproofing of Dr. Fixit Fastflex or approved equal, high performance, highly elastomeric (elongation >120%), polymer modified cementitious coating in 3 coats to achieve a minimum DFT of 1.5mm. The coating has to be extended vertically 1200 mm along the height of the wall on all the sides. A protective Geotextile fabric on top of 200 GSM shall be laid over the entire horizontal surface. Base screed for tiling shall be laid to proper slope.

SPECIFICATIONS FOR MODULAR FURNITURE

PANEL BASED MODULAR PARTITION SYSTEM AS PER SELECTION:

A. PARTITION PANELS : The thickness of the partition is 60mm or as per selection. The partition is made of MDF board with appropriate material to give strength, stability and other functional needs. 25mm MDF board covered with fabric except where glass is required. As per design soft board and white marker board are provided. The partition panels are finished with fabric/ laminate/ glass or in combination as per design. The glass panels will have plain glass of 6mm thickness. The partition has exclusively designed Aluminum extrusions for the top trims, raceway covers, cable tray, corner trims and channels for glass. Each partition panels is provided with leveling bolts to take care of the unevenness in the floor level. The partition panels can be made to any height as per client's requirement .The panels are joined by slotted ms channels. The slot is used to fix work surface and storages with the help of ms brackets at any desired height.

B. RACEWAY AND CABLING FACILITY

All the partition has two integrated raceway provided one at skirting level and another at the work surface level thus ensuring separation of power and networking cables. The free space available within raceway accommodation power, data and communication cables. The cable can be taken into the panels from the bottom through floor trucking. Once the cables enter the panels it can be taken for one end to the other end continuously as per Power/Lan layout plan. Approximately 90 to 100(5mm dia) cables can be accommodated in the raceway channels. The raceway at the skirting level will be provided with CRCA .8 MM with Powder coating snap cover on both side of Skirting level only. The second raceway at the table top level will not have a snap cover but instead the slot cutting of the switches will be done on the laminate or fabric panel. The cable running at skirting level can be terminated at table top level through disciplined wiring channels provided inside the panels. The partition panels have aluminum cables tray at skirting level to carry the cables away from the floor.The raceway cover at the skirting level will be provided with appropriate electrical switch cutouts, as per the samples of switches. The switch cutouts for above table top will be done on the laminate or fabric panel as indicated & number Of cutouts in each workstation would depend upon the size of the switches.

C. WORK SURFACE: The Work Tops is made of 25mm thick MDF board. The surface will be post formed by 0.8mm thick laminate to provide rounded edges. The bottom surface will also be laminated.MS brackets that will be powder coated to 50 to 60 microns will support the worktops. The tables will be lipped with the Pvc edge band of 1.0mm to 2.0mm thickness. The CNC machine provides high level consistency in dimensions & curvilinear profiles. Following are the Exclusive features:- a) The table tops will be provided with flap box for cabling. b) The work surfaces with straight portion curvilinear profiles to add to the aesthetics and ergonomics. c) The work surface can be fixed to any desired height and subsequently changed to any height very easily without the necessity to dismantle the complete system. d) The work surfaces are offered in a variety of shapes and sizes to meet the functional/aesthetics requirements. E.G typical computer workstation, peninsular, circular, semicircular, elliptical table tops.

II. DRAWER UNITS AND STORAGES: 3D pedestal (Post formed top)(mobile) size: Minimum 400(W)X495(D)X700(H). It is mounted on twin wheel lockable 4 nos of castors and consists of 2 small drawers and 1 full drawer. The bottom and sides are fabricated out of 18mm thick.1 side pre laminated board. The fascia is fabricated out of 18mm thick MDF board with laminate finish. The top is of 18mm MDF board 0.8mm thk. Post formed laminate on top position 0.7mm thk. Balancing laminate on back. The back will be of 9mm thk MDF boards. The side panels of drawers fabricated out of MS sheets & bottom with MDF boards and assemble with drawers, runners, for smooth operation. A single locking system is provided. All metal components will be finished in epoxy powder coating. All exposed edges will be 1.2 mm thick. PVC lipping finish.

VERTICAL STORAGE UNITS (MDF BOARD FINISH) : All components except top &bottom are fabricated out of MDF Board.. The shutters is made out of 25mm thk MDF Board and fitted by auto-closing hinges and with suitable locking arrangement. The handles are of brush steel finish. All storages are provided with suitable levelers to cater for floor undulation. The necessary knock down fittings, locks, and stoppers will have to be provided. All board components edge are finished with PVC Lipping. The 750mm High VSU will be provided with sliding shutters while 1200mm high VSU will be provided with open able shutters. The top is fabricated of 25mm prelam MDF board with PVC Lipping.

There should be minimum of 100mm skirting and 10-20mm height adjustable system at the bottom to adjust unevenness of the floors. While for 1200mm high there should be 2 shelves and for 750mm high there should be 1 shelf. All shelves will be adjustable. For 2100mm High storage there should be 4 shutters, 2 partitions 7 at least 5 shelves. If the storages shall be metal box type, then all exposed position will have to be covered with the 18mm thk.Pre lam MDF board.

IV. DISCUSSION AND CONFERENCE TABLES The discussion and conference tables are also offered to meet the complete office needs. The supports will be made of either steel pipes or 25mm MDF Board The legs will be provided with leveling screws. The Tabletops are lipped with PVC edge band. The conference tables are made modular to increase / decrease the capacity. For Round Tables: The Table top is made of 12 mm thk. Tinted glass whose edges will be properly babbling of 25mm.The top is supported on metal base of 150 mm dia. The dia. Of 150mm should have rubber shoe at the finishing point for water Protecting.

For Big Conference Table :

The top is fabricated out of 38 mm MDF board with duly PU coating or Veneer with Melamine polish/finish on the top position while the back side of the top, Should have the balancing laminate. The edges will be duly chamfered on and finished with PU coating. The Top will be supported on 25mm black stained boards side. The shape of the table will be oval whose middle part will be 1000mm wide while the two ends will be 750 mm wide. All board sides will be interconnected to increase the strength of the table. ON the middle of the table top there should have complete wire management facility both for the LAN socket and for the electrical socket.

SPECIFICATIONS FOR WOOD WORK

1.0 SCOPE:

The works covered under this specification consist of providing, making and fixing of wooden frames for doors in accordance with these specifications and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards

| No. | I.S. No. | I.S. Particulars |
|-----|--------------------------|--|
| 1 | I.S. 287 | Recommendations for maximum permissible moisture content of timber. |
| 2 | I.S. 401 | Code of practice for preservation of timber. |
| 3 | I.S. 851 | Specification for synthetic resin adhesives for construction work in wood. |
| 4 | I.S. 1141 | Code of practice for seasoning of timber. |
| 5 | I.S. 1200 (Part-XXI) | Method of measurement of building and civil engineering works. (Wood work and joinery) |
| 6 | I.S. 1708 (Part-1 to 18) | Method of testing of small clear specimens of timber. |
| 7 | I.S. 7196 | Specification for hold fast. |

3.0 TEAK WOOD FRAMES:

Door frames shall be of the best quality timber of C.P. teak wood as specified and wrought and put up to section as indicated on the drawings or as directed by the Architects.

They shall be properly framed and mortised and tongued together at right angles and set correctly in the masonry or concrete.

The door frame shall rest on structural slabs and not on finished floor level.

M.S. holdfasts 230 mm long, 40 mm wide and 3 mm thick shall be fixed as shown in drawing or as directed by the Architects to hold the teakwood rough ground frames/ door frames firmly in the masonry.

Where the rough ground/ frames are placed by the side of concrete surface they shall be fixed firmly against the concrete surface by means of teak wood gutties and screws. All m. s. hold fast shall be fastened to the frame using adequate number of M. S. screws.

The surfaces of frames in contact with masonry or concrete shall be painted with two coat of bituminous paint.

The frame shall be as per drawing and shall be provided with triangular keys for the plaster if indicated in the drawing.

All frames shall be protected with one coat of approved wood primer as specified.

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While fixing the frames in position, the vertical members shall be held rigid temporarily by means of wooden battens to avoid bending or distortion of members and to keep door frame exactly in plumb.

The teakwood beading/ cover mould/ stopper of the specified sizes shall be fixed on to the frame as shown in the drawings and shall be fixed on to the frame as shown in the drawings and shall be free from knots and sap wood.

4.0 MODE OF MEASUREMENT:

The door frame & door shall be per nos.

SPECIFICATIONS FOR FLUSH DOOR SHUTTER

1.0 SCOPE:

The works covered under this specification consist of providing and fixing block flush door shutter in accordance with the specification and drawings.

2.0 APPLICABLE CODES & SPECIFICATIONS:

The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards

| No. | I.S. No. | I.S. Particulars |
|-----|--------------------------|--|
| 1 | I.S. 204 (Part – I) | Specification for tower bolts (ferrous metal) |
| 2 | I.S. 204 (Part – II) | Specification for tower bolt (non ferrous metal) |
| 3 | I.S. 208 | Specification for door handles |
| 4 | I.S. 723 | Specification for steel countersunk head wire nails. |
| 5 | I.S. 848 | Specification for synthetic resin adhesives for plywood |
| 6 | I.S. 1200 (Part – XXI) | Method of measurement of building and civil engineering works. (Wood work and joinery) |
| 7 | I.S. 1341 | Specification for steel butt hinges. |
| 8 | I.S. 1659 | Specification for block boards. |
| 9 | I.S. 1708 (Part-1 to 18) | Method of testing of small clear specimens of timber. |
| 10 | I.S. 1734 (Part-1 to 20) | Method of test for plywood. |
| 11 | I.S. 2202 | Specification for wooden flush door shutters. (Solid core type). |
| 12 | I.S. 2209 (Part – I) | Specification for mortise lock of timber. |
| 13 | I.S. 3564 | Specification for door closers. |
| 14 | I.S. 4992 | Specification for door handles for mortise lock. |
| 15 | I.S. 6760 | Specification for slotted counter sunk head wood screws. |

3.0 BLOCK BOARD FLUSH DOOR SHUTTER:

Flush door shutter shall have a solid core and may be of the decorative or non-decorative type conforming to I.S. 2202.

The thickness and type of shutter shall be as specified in item of schedule of quantities. Width and height of shutter shall be as shown in the drawings or as directed by the Architects. All four edges of shutter shall be square.

The shutter shall be free from twist or warp in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 percent when tested according to I.S. 1708.

The core of flush door shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. The width of the stiles and rails shall not be less than 75 mm and not more than

100 mm. The width of each wooden strip shall not exceed 25 mm. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles.

End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails shall be of one species of timber. Wooden strips shall also be one species only but it may or may not be the same species as that of the stiles and rails

The face panel shall be formed by gluing by the hot-press process on both faces of the

core either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneer and between 0.5 and 1.0 mm for decorative veneers. The direction of the veneer adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture.

Leaping where specified, shall be provided internally on all edges of the shutters. Leaping shall be done with battens of first class teakwood or as specified. Joints shall not be permitted in leaping.

The shutters shall be single leaf or double leaves as shown in the drawings or as directed by the Architects. In case of double leaves shutters the meeting at stiles shall be rebated by one third the thickness of the shutter. The rebating shall be either splayed or square type.

Wherever specified the opening for glazing of size as shown in drawing or as directed shall be made in the shutter for vision panel and or louver. Opening for glazing shall be made in the shutter for vision panel and or louver. Opening for glazing shall be lipped internally with teakwood batten of specified size.

Tolerance on width and height shall be (+) 3 mm and on thickness it shall be (+) 1.2 mm. The thickness of the door shutter shall be uniform through out with a permissible variation of not more than 0.8 mm when measured at any two points.

Adhesive used for bonding various components like core, core frame, leaping, cross bands, face veneers plywood etc. of flush door shutters and for bonding plywood shall be phenol formaldehyde synthetic resin conforming to I.S. 848.

Samples of flush door shutters shall be subjected to following tests in accordance with

I.S. 2202 (Part – I & II):

End immersion test. Knife test.

Glue adhesion test.

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All the sample shutters when tested shall satisfy the requirements of the tests as laid down in I.S. 2202 (Part – I & II) if the number of samples found unsatisfactory or a test is two or more the entire lot shall be considered unsatisfactory.

Fittings shall be provided to the contractor free of cost by the Department as decided by Employer. Screws for fixing these fittings shall be provided by the contractor and nothing extra shall be paid for the same.

4.0 MODE OF MEASUREMENT:

Length and width of the shutter shall be measured to the nearest centimeter in closed position covering the rebates of the frames but excluding the gap between the shutters and the frame. Over laps of two shutters will not be measured.

All work shall be measured net as fixed and area calculated in square meter to nearest two places of decimal.

No deduction shall be made for providing openings for vision panel/ louvers.

Rate quoted for the items shall cover all the specifications described above and for the complete work as per item of work including all labour and materials.

The work of providing vision/ louver opening and making rebates in double shutter doors shall be measured and paid for under relevant item of schedule of quantities.

5.0 TEAK WOOD GLAZED SHUTTERS:

The specifications for teak wood paneled shutter shall generally apply to glazed Shutters for frame, stiles etc.

The sash and beading required for glazing shall be of the best teak wood and shall be fixed as per the design shown in relevant drawing. Any mouldings, carvings shown shall be worked out from the teak wood member of bigger size.

6.0 GLAZING:

Glazing shall be generally with 4 mm. Thick plain sheet glass/bajra glass unless otherwise mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

7.0 MISCELLANEOUS:

Wherever mentioned in the Schedule of quantities, vision panels, Venetians, plastic

laminates, push plates etc. shall be provided in all doors. The vision panels shall be of size mentioned in the drawing and shall be provided with teak wood leapping all-round the glass. The glass shall be 4 mm. thick or as specified of best quality, free from defects.

Teak wood Venetians or louvers shall generally conform to relevant specifications of timber. Necessary grooves and rebate in frames shall be provided as per drawing. Formica or approved equivalent plastic laminate of required design, required shade and colour shall be provided and fixed on flush door to the required size on any side of the shutter as shown in drawing. It shall be fixed with Fevicol or any other approved adhesive. Fixing shall be done in such a way that there shall not be any air gap, warpage or undulations on the surface. Finished surface of Laminate shall be cleaned. The shutters shall be painted on commercial facing side with two coats of synthetic/flat oil paint of approved shade and make over an approved coat of primer. The decorative veneer side of the shutter shall be wax or French polished with two or more coats so as to render a satisfactory surface.

The flush doors shall be single leaf or double leaf type as mentioned in the schedule of quantities. In case of double leaf shutters, the meeting of the stiles shall be

rebated 20 mm. And shall be either splayed or square type or the T.W. Leaping around the meeting shall not be less than 35 mm. deep. The meeting stiles shall be in single piece. Sufficient care shall be taken to prevent any damage and loss of shape during handling, transporting, stacking, fixing etc. The door shutters shall be handled with utmost care to prevent any surface damage, warping etc.

8.0 MODE OF MEASUREMENT:

The work covered under the respective items in schedule and the above specifications shall be measured as follows:

The cubic contents for wood work shall be measured for the finished size, limiting to those shown in the drawings or ordered by the Architects. The cross sectional dimensions shall be measured equivalent to nearest enclosing rectangle (least rectangle/square) for wrought and planed sizes. The cubical content shall be worked out correct up to three places of decimals of a cubic meter. The frames embedded below finished floor shall not be measured.

The square meter areas for shutters shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more. The linear The square meter areas for shutters shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more. The linear dimensions shall be measured upto two places of decimals of a meter. The area for payment shall be worked out correct upto two places of decimals of a square meter. The rate for shutters shall include:

- i) Cost of supply assembly and erecting in position.
- ii) Cost of polishing, painting, supplying wood preservative, screws, nails, hold fasts etc.
- iii) Cost of labour for making adjustments in frames, if required, shutters and also for fixing required fittings and fixtures.
- iv) In case of flush doors, the rate for individual item mentioned in the schedule of quantities shall include cost of shutters, labour for provision of glass for vision panel, plastic laminate sheet push plate, teak wood louvers etc., transporting charges and labour for fixing of fixtures and fastenings except fixing of door closers and painting and polishing as specified.

SPECIFICATIONS FOR FITTINGS AND FIXTURES

1.0 SCOPE OF WORK:

The works covered under these specifications consist of supplying different types of fittings and fixtures required for doors, windows, ventilators etc. The supply shall be in accordance with the specification, drawings / approved samples. Samples of various fittings and fixtures proposed to be incorporated in the work shall be submitted by the contractor for approval of the Architects and Employer before order for bulk supply is placed.

2.0 GENERAL:

All fittings and fixtures shall conform to relevant IS code and made of brass, anodized aluminium, iron oxidized (M.S.) or as specified. These shall be well made reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the heads of the specified screws. All hinges pins shall be of steel for brass hinges and aluminium alloy NR-6 or steel pins for aluminium hinges with nylon washers or as specified. All riveted heads pertaining to hinge pins shall be well formed. Screws supplied for fittings shall be of the same metal and finish as the fittings. However brass cadmium plated/chromium

plated screws shall be supplied with aluminium fittings. Samples of each fixture/ fitting shall be furnished by the contractor for approval of the Architects and Employer. Order for procurement of fittings and fixtures in bulk shall be placed only after approval by the architects and Employer.

The fittings and fixtures to be incorporated in the work shall be strictly according to the approved sample. Fittings shall be fixed in proper position as shown in the drawing and as directed by the Architects. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with a screwdriver and not hammered in. Recess shall be cut to the exact size and depth for the counter sinking of hinges. The fittings and fixtures shall be fixed in a workman like manner and any damages done either to fittings and fixtures or to the shutter frames etc. should be rectified by the contractor at his own cost.

Fittings shall be of Mild steel, Stainless steel, aluminium, brass or as specified. The fittings shall be well made, smooth, and free from sharp edges and corners, flaws and other defects.

Mild steel fittings shall be bright satin finish black stone enameled or copper oxidized (black finish), nickel chromium plated or as specified.

Aluminium fittings shall be anodized to natural matt finish or dyed anodic coating less than grade AC 10 of IS: 1868

Stainless steel fittings shall be non-magnetic, rust & moisture proof, strong & sturdy. Pin of hinges shall also be of stainless steel.

3.0 BUTT HINGES:

Brass and aluminium hinges shall be manufactured from the extruded sections and shall be free from cracks and other defects. M.S. butt hinges shall be free from cracks and other defects. M.S. butt hinges shall be cranked and manufactured from M.S. Sheets. All butt hinges shall conform to latest I.S. specifications butt hinges shall generally conform to relevant I.S viz IS 1341 (M.S.) IS : 205 (Cast brass & aluminium, IS : 362 (Parliament hinges); IS : 453 sprig hinges, IS : 3818 (Piano hinges) etc. The size of butt hinges shall be taken as the length of the hinge. Width of the hinge shall be measured from the centre line of hinge pin to end of flange.

4.0 PARLIAMENTARY HINGES:

These shall be manufactured from extruded section for brass and aluminium and from M.S. sheets for iron oxidized and shall be free from cracks and other defects. The size of the parliamentary hinges shall be taken as the width between open flanges, while the depth shall be as specified.

5.0 PIANO HINGES:

These shall be generally conformed to I.S. 3818 and shall be made of brass oxidized, aluminium anodized, iron oxidized (M.S.) or as specified. Piano hinges shall be fixed in the entire length of the cupboard shutters in a single piece. No joints shall be allowed. Crank

6.0 BOX HINGE:

These shall be manufactured from screw on nickel plated steel with opening angle 95 degree, cup diameter 35mm. These shall be 16mm cranked. The size of butt hinges shall be taken as the length of the hinge.

7.0 TOWER BOLTS:

These shall generally conform to IS 204 (Part II & I). They shall be well made and shall be free from defects.

The tower bolts shall be of the following types:

- i) MS semi barrel tower bolt with ms sheet pressed barrel and G.I. bolt or with ms barrel and MS Sheet bolt.
- ii) Oxidized brass barrel tower bolt with brass sheet barrel and rolled or drawn brass bolt
- iii) Anodized aluminium tower bolt with barrel and bolt of extruded sections of aluminium alloy.
- iv) In case of M.S. tower bolt plates and straps after assembly shall be firmly riveted or spot welded properly.
- v) The knobs of brass tower bolts shall be cast and the bolt fixed into the knob firmly as per I.S. specifications. The tower bolt shall be finished to correct shape and pattern so as to have a smooth action. Wherever specified, aluminium barrel tower bolts shall be manufactured from extruded sections of barrel & bolts.
- vi) Knobs shall be properly screwed to the bolt and riveted at the back. The size of the tower bolt shall be taken as the length of barrel without top socket.

8.0 DOOR LATCH:

This shall be of MS, cast brass or as specified shall have smooth sliding action. MS Latch shall be copper oxidized (black finish) or as specified. Brass Latch shall be finished bright, CP or oxidized or as specified

9.0 ALDROPS:

These shall be oxidized brass or anodized aluminium, iron oxidized or as specified and shall be capable of smooth sliding action and shall be as per relevant I.S. Brass sliding door bolt (aldrop) shall be made from rolled brass generally conforming to IS :2681. M.S. sliding door bolt shall generally conform to I.S.281. The hasp shall be of cast brass and screwed to the bolt in a workman like The hasp shall be of cast brass and screwed to the bolt in a workman like manner. Alternatively the hasp and the bolt may be in one piece. Bolts shall be finished to shape and threaded with worth standard and provided with round brass washers and nuts of square or hexagonal shape. All components shall be smooth and polished. The leading dimensions of aldrop shall be as the length of the bolt and specified diameter.

10.0 DOOR HANDLES- BOW/PLATE HANDLES:

These should generally conform to IS : 208. Unless otherwise specified door handles shall be of 100 mm size & windows handles of 75 mm size. These shall be of cast brass of specified size, shape and pattern as approved by the Architects. All edges and corners shall be finished smooth and correct to shape and dimensions. Brass handles shall be finished bright, chromium plated or oxidized as specified. Anodized aluminium or iron oxidized (m.s.) handles shall be of specified Brass handles shall be finished bright, chromium plated or oxidized as specified. Anodized aluminium or iron oxidized (m.s.) handles shall be of specified size, shape and pattern. The size of the handle is taken as the inside grip of the handle. In case of iron oxidized handles, the same shall be manufactured from m.s. sheet pressed into oval section as per I.S.

11.0 MORTISE LOCK & LATCH:

This should generally conform to I.S. 2209. Handles shall conform to IS 4992. Mortise lock with latches and a pair of level handles shall be 6 levers, with zinc alloy pressure die cast/ brass or as specified body of approved quality and shall be right or left handed as specified. The pair of handles shall be either brass chromium plated or anodized aluminium of approved shape and pattern or as specified. It shall be of the best Indian make of approved quality. The size of the lock shall be determined by its length. The lock for single leaf door shall have plain face and that for double leaf door a rebated face. Level handles with springs shall be mounted on plates and shall be of approved quality, anodized aluminium or as specified.

12.0 HYDRAULIC DOOR CLOSER:

This shall be generally conform to IS: 3564. Hydraulic door closer shall be of approved quality and make. The operation of the Hydraulic door closer shall be very smooth. This should be of H.D.-66 for external/main doors and elegant - 63 for all internal doors. The overall height should not be more than 170 mm. for H.D.-66 and 160 mm. for elegant - 63, base shall be 110 x 60 mm. for H.D.-66 and 100 x 55 mm. for elegant -63 weighing not less than 4.5 kg. for H.D.-66 and 4 Kg. for elegant - 63. Speed of the Hydraulic door closer shall be adjustable and latch closing also shall be adjustable type. Suspension and lubrication of door closer shall be in perfect line and level.

12.0 The contractor shall provide for all the incidentals required for fixing these fixtures and fittings such as cadmium plated screws etc. Fittings and fixtures shall be fixed securely in a workman like manner all as directed by the Engineer-in-charge. Any of the fixtures damaged during the fixing shall be removed and new one fixed in their place and the surface of joinery made good where affected, at his own expense. Mortise plates shall be used over holes where the bolts enter in the wood work. Metal sockets shall be provided to all bolts where the shoot enter brick, stone, concrete etc. The incidental Fixtures like mortise plates, metal sockets, screws etc. shall not be paid for separately.

13.0 MORTICE NIGHT LATCH:

This is a mortice lock having a single spring bolt withdrawn from the outside by using the key and from inside by turning the knob and with an arrangement whereby the lock can be prevented from being opened by its key from outside while the night latch is used from inside the room.

This should generally conform to IS: 3847. It shall be cast or sheet brass, cast or sheet aluminium alloy or mild steel as specified and of approved make. These shall be bright finished or copper oxidized (black) finish as specified. Normal size of the latch shall be denoted by the length of the face over the body in millimetres.

14.0 FLOOR DOOR STOPPER:

The floor door stopper shall conform to IS: 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Architects. It shall be of brass finished bright, chromium plated or oxidized or as specified. The size of door stopper shall be determined by the length of its plate. The body of the door stopper shall be cast in one piece. All parts of the door stopper shall be of good workmanship and finish and free from surface and casting defects. Aluminium stopper shall have anodic coating of not less than grade AC-10 of IS 1868.

15.0 MODE OF MEASUREMENT:

All the fittings with all the necessary accessories shall be measured in numbers and the rate shall include the cost of all materials including taxes, excise duty, if any, loading, unloading, transporting, cost of screws, bolts and other accessories complete, if the same are not to be paid for separately as per schedule of quantities.

SPECIFICATIONS FOR GLASS AND GLAZING

1.0 SCOPE OF WORK:

The work covered by this specification include furnishing and fixing the glass panes to teak wood or steel doors and windows, strictly in accordance with these specifications and drawings.

2.0 MATERIALS:

2.1 Glass:

The glass shall be special selected/selected ordinary quantity of Saint Gobain/ AIS or of equivalent manufacture, as specified and it shall be free from bubbles, flaws specks, waves, air holes, distortion, scratches or other defects. The glasses in bulk quantities shall be brought to site in Makers original packings and Makers guarantee shall be produced if called for by the Architect and Employer. The glass shall be of required thickness as mentioned in the items of schedule of quantities and or drawing or as directed by the Architects. The contractor shall submit the sample of the glass which he proposes to use on the work and only such approved quality of glass shall be used in the works. The glass brought to site shall be protected against damages. Wherever frosted (obscure) glass is mentioned in the item of schedule of quantities and/or shown in drawings, the glass shall be of sand blown pattern and shall also be got approved by the Architect and Employer.

2.2 Beading :

The beading shall be of teak wood of superior quality timber in case of teak wood doors and windows and/or required sizes mentioned in the items of schedule of quantities and/or shown in drawing. In case of steel doors and windows, the beading shall be anodized aluminium beading of channel section as per sizes mentioned in the item and/or shown in the drawing. The junction of the beadings shall be mitre jointed.

3.0 WORKMANSHIP:

The glass shall be cut to the required sizes of panels where it is to be fitted, and it shall be so cut that it fits properly in the frames without rattling. Pre-measurement of each panel prior to the cutting of glass is essential.

The beading shall then be fixed to glass panes and screwed at close intervals not more than 10 cm. from each corner and the intermediate not more than 20 cm. apart. When glass panes are fixed with wooden beadings having mitred joints or aluminium beading thin layer of glazier putty shall be applied covering the area in contact between the glass and sashbars and beadings. In case of louvers, all the exposed edges of the glass shall be ground properly.

4.0 GENERAL:

After the inspection is over and permitted by the Architects, glass panes shall

be cleaned off any labels, paints smears and spots and shall be washed from both the sides and all glazing left clear, perfect and free from rattling. The contractor shall provide all the scaffolding, tools and plants for fixing the glass panes at his own cost. In case of steel windows, any hardware if fixed in position, shall be removed temporarily before fixing the glass panes and which shall be re fixed back in position, all at the contractors cost.

5.0 MODE OF MEASUREMENT :

The rate for teak wood door/window shutters and/or steel door/window shall normally cover the cost of glass and glazing also, unless otherwise mentioned. In case the glazing is carried out as a separate item, the measurement shall be taken out to cut size of teak wood/steel door/window frames forming the sides of glass panes and area calculated to two places of decimal of a square meter.

The rate shall include the cost of supplying and fixing the glass panes, all materials, labour, transport, scaffolding etc.

SPECIFICATIONS FOR PAINTING

1.0 SCOPE OF WORK:

The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

2.0 MATERIALS:

2.1 Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Architects shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnights work. The materials shall be kept in the joint custody of the contractor and the Employer. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Architect and Employer.

2.2 The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

3.0 COMMENCING WORK:

3.1 Scaffolding: Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being painted.

3.2 Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

3.3 For painting of the ceiling, proper stage scaffolding shall be erected.

3.4 Painting shall not be started until and unless the Architects has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

3.5 Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished one day in advance of the paint work being started.

4.0 PREPARATION OF SURFACE:

4.1 The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered/form finished surfaces shall be repaired and finished in line and level in C.M. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Architects after inspection, before painting is commenced.

5.0 APPLICATION:

5.1 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

5.2 The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Client/ Architect's approval before taking up the work in hand and they will be allowed to proceed with the work only after getting approval for the same.

5.3 The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing alternately in opposite directions two or three time and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.

5.4 Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

5.5 Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.

5.6 Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

5.7 Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

5.8 No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.

5.9 The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

5.10 In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surface

es shall be kept damp for at least two days.

- 5.11** In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Perspect covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.
- 5.12** The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings.
- 5.13** Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor at his own cost.

6.0 BRUSHES AND CONTAINERS:

- 6.1** After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean & can be used again.

7.0 MEASUREMENT:

- 7.1** Painting, unless otherwise stated shall be measured by area in square metre. Length and breadth shall be measured correct upto two places of decimal of a metre.
- 7.2** No deduction shall be made for opening not exceeding 0.05 sqm. and no addition shall be made for painting to the beading, moulding edges, jambs, soffits, sils, architraves etc. of such openings.
- 7.3** In measuring painting, varnishing, oiling etc. of joinery and steel work etc., the co- efficiencies as in the following table shall be used to obtain the areas payable. The co- efficiencies shall be applied to the areas measured flat and not girthed in all cases.
- 7.4** In case of painting of door shutter with push plates in plastic laminate, deduction will be made for area of such laminations.
- 7.5** Table of Co-efficients to be applied over areas of different surfaces to get equivalent plain areas.

| 1) | DESCRIPTION OF WORK | MULTIPLYING CO-EFFICIENTS |
|----|---|---------------------------|
| I. | WOOD WORK : DOORS, WINDOWS ETC. | |
| 1 | Panelled or framed and braced doors, windows etc. | 1.30 (for each side) |
| 2 | Ledged & battened or ledged, battened & braced doors, windows | |
| 3 | Flush doors etc | 1.20 (for each side) |
| 4 | Part panelled and part glazed or gauzed doors, | 1.00 (for each side) |
| 5 | Fully glazed or gauzed doors, windows etc. | 0.80 (for each side) |
| 6 | Fully venetioned or louvered | 1.80 (for each side) |

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| | | |
|---|--|------------------------------|
| | doors, windows etc. | |
| 7 | Trellis (or Jaffri) work one way or two way. | 2.00 (for painting all over) |
| 8 | Carved or enriched work: | 2.00 (for each side) |
| 9 | Weather boarding: | 1.20 (for each side) |
| 10 | Wood shingle roofing: | 1.10 (for each side) |
| 11 | Boarding with cover fillets and match boarding. | 1.05 (for each side) |
| 12 | Tile and slate battening: | 0.80 (for painting all over) |
| II. | STEEL WORK: DOORS, WINDOWS ETC. | |
| 13 | Plain sheeted steel door or windows: | 1.10 (for each side) |
| 14 | Fully glazed or gauzed steel doors and | 0.50 (for each side) |
| 15 | Partly panelled and partly gauzed or glazed doors and windows. | 0.80 (for each side) |
| 16 | Corrugated sheeted steel doors or windows. | 1.25 (for each side) |
| 17 | Collapsible gates | 1.50 (for painting all over) |
| 18 | Rolling shutters of inter locked laths. | 1.10 (for each side) |
| III. | GENERAL WORKS : | |
| 19 | Expanded metal, hard drawn steel wire fabric of approved quality, grill work and gratings in guard bars, balusters, railings, partitions and | 1.00 (for painting all over) |
| 20 | Open palisade fencing and gates including standards, braces, rails, stays etc. in timber or steel | 1.00 (for painting all over) |
| NOTE: The height shall be taken from the bottom of the lowest rail, if the palisades do not go below it (or from the lower end of palisades, if they project below the lowest rail) upto the top of palisades but not upto the top of standards, if they are higher than the palisades. | | |

8.0 Explanatory notes on the table of Co-efficients.

- 8.1** Where doors, window etc. are of composite types other than those included in para7.3, the different portions shall be measured separately with their appropriate co- efficient, the centre line of the common rail being taken as the dividing line between the two portions.
- 8.2** Measurements for doors, windows etc. shall be taken flat (and not girthed) over all including chowkhats or frames, where provided. Where chowkhats or frames are not provided, the shutter measurements shall be taken.
- 8.3** Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide, rails, rollers, fittings etc.
- 8.4** Rolling shutters of interlocked laths shall be measured for the actual shutter width and shall be taken for painting guides and other exposed features within or outside the shutter area. The painting of top cover or hood shall however be measured

separately.

- 8.5** Co-efficients for sliding doors shall be the same as for normal types of doors as mentioned in the table. Measurements shall be taken outside of shutters, and no separate measurements shall be taken for painting guides, rollers, fittings etc.
- 8.6** Measurement of painting of doors, windows, collapsible gates, rolling shutters etc. as above shall be deemed to include painting all iron fittings in the same or different shade for which no extra will be paid.
- 8.7** The measurements as above shall be deemed to include also the painting of edges, blocks, cleats etc. for which no extra will be paid.
- 8.8** The co-efficients for doors and windows shall apply irrespective of the size of frames and shutter members.
- 8.9** When the two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Architects, and measurement of this will be deemed to be included in the measurement of the face treated with that finish.
- 8.10** In the case where shutters are fixed on both faces of the frames, the measurements for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter area only excluding the frame.
- 8.10.1** Where shutters are provided with clearance at top or/and bottom, such openings shall be deducted from the over all measurements and relevant co-efficients shall be applied to obtain the area payable.
- 8.11** In case of trellis (or jaffri) work, the measurements shall include the painting of the frame member for which no separate measurements shall be taken. Trellis door or window shutters shall also be measured under terllis work.
- 8.12** Wherever air conditioning grill, lighting, fixtures etc. in false ceiling are painted along with, measurements shall be taken over all without deductions for opening in grills and no extra shall be paid for the grills. If grills, fixtures etc. are not painted, area of fixtures or grills as measured flat (not girthed) shall be deducted when it exceeds 0.05 sqm. individuals. Where walls and ceilings are painted in separate colours, the junctions of two paints shall be brought down on the walls in a straight line by about 6mm.to12mm. if so desired, if the junctions of walls and ceilings are not even. Nothing extra shall be paid to the contractor on this account. Beading wherever provided shall not be measured separately but shall be deemed to be included in the area of false ceiling etc. measured flat (not girthed).
- 8.13** For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), upto the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or palisades.
- 8.14** In the case of asbestos cement corrugated or semi-corrugated sheeting and iron corrugated sheeting in roofs, side cladding etc., the work shall be measured flat (not girthed) as fixed.
- 8.15** For trusses, compound girders, stanchions, lattice girder and similar work, actual areas will be measured in sqm. and no extra shall be paid for painting on bolt heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work. running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes etc. shall be included in the length and no separate measurements shall be taken for these or for painting brackets, clamps etc.
- 8.16** Measurements of wall surfaces and wood and other works not referred to already shall be recorded as per actual and opening exceeding 0.05 sqm. shall be deduct-

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ed to get the net payable area. Length and breadth shall be measured correct up to two places of decimal of a metre and area so worked out shall be correct up to two places of decimal of a square metre.

8.17 In case the items of work requiring painting are inclusive of cost of painting, the painting carried out shall not be measured separately.

9.0 PRECAUTIONS:

9.1 All furnitures, lightings, fixtures, sanitary fittings, glazing, floors etc. shall be protected by covering and stains, smears, splashings, if any shall be removed and any damage done shall be made good by the contractor at his cost.

10.0 RATES:

10.0 Rates shall include cost of all labour and materials involved on all the operations described above and in the particular specifications given under the several items.

11.0 PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES:

11.1 Primer

11.0.1 The primer for wood work, iron work or plastered surface shall be as specified in the description of the item.

11.0.2 Primer for Wood work/ Iron & Steel/ Plastered/ Aluminium surfaces shall be as specified below:

| SN | SURFACES | PRIMER TO BE USED |
|----|---|---|
| a | Wood work (hard & soft wood): | Pink conforming to I.S.3536-1966 |
| b | Resinous wood and ply wood: | Aluminium primer |
| c | Iron & Steel, Aluminium and galvanised Steel work: | Zinc chromate primer conforming to I.S. 104-1962. |
| d | Plastered surfaces, cement brick work, Asbestos surfaces for oil bound distemper and paint: | Cement Primer |

11.0.3 The primer shall be ready mixed primer of approved brand and manufacture.

11.1 Preparation of surface :

11.1.1 Wood work: The wood work to be painted shall be dry and free from moisture.

11.2.1.1 The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with same shade as paint shall be used where so desired by the Architects.

11.2.1.2 The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty

and wood putty- refer as mentioned here-in-before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

- 11.1.2 Iron and Steel Work: All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.
- 11.2.2.1 All dust and dirt shall be thoroughly wiped away from the surface.
- 11.2.2.2 If the surface is wet, it shall be dried before priming coat is undertaken.
- 11.1.3 Plastered Surface: The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall be taken in hand. Before primer is applied, holes and undulations shall be filled up with plaster of paris and rubbed smooth.
- 11.2 Application: The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described here-in-before.
- 11.3 Other Details : The specifications for Painting (General) in para 32.2 shall hold good so far as it is applicable.

12.0 PAINTING WITH SUPERIOR QUALITY & FLAT OIL READY MIXED PAINTS ON NEW SURFACE :

12.0 Paint: Ready mixed paints shall be of approved brand and manufacture and of the required shades. They shall conform in all respects to the relevant I.S. specifications.

12.1 Preparation of Surface:

12.1.1 Wood work: The surface shall be cleaned and all unevenness removed as in para

11.2. Knots if visible shall be covered with a preparation of red lead. Holes and indentations on the surface shall be filled in with glaziers putty or wood putty and rubbed smooth before painting is done. The surface should be thoroughly dry before painting.

12.1.2 Iron and steel work: The primer coat shall have dried up completely before painting is started. Rust and scaling shall be carefully removed by scraping or by brushing with steel wire brushes. All dust and dirt shall be carefully and thoroughly wiped away.

12.1.3 Plastered surfaces: The priming coat shall have dried up completely before painting is started. All dust or dirt that has settled on the priming coat shall be thoroughly wiped before painting is started.

12.2 Application: The specifications mentioned here-in-before shall hold good as far as applicable.

12.3 The number of coats to be applied will be as stipulated in the item. The painted surface shall present a uniform appearance¹ and glossy/semi glossy finish, free from streaks, blisters etc.

12.4 Other details: The specifications for Painting (General) specified here-in- before shall hold good in so far as they are applicable.

13.0 PAINTING WITH SYNTHETIC ENAMEL/ SEMI GLOSSY PAINT ON NEW WORK:

13.0 Paint: Synthetic enamel/semi glossy paint of approved brand and manufacture and required shade shall be used for the top coat and an under coat of shade to match the top coat as recommended by the manufacturer shall be used. The paint shall be conforming to IS: 1932-1964.

13.1 Preparation of Surface: This shall be as per painting with superior quality ready

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mixed paint as mentioned here- in- before.

- 13.2** Application: The number of coats including the under coat shall be as stipulated in the item.
- 13.3** Under Coat: One coat of the specified paint of shade suited to the shade of the top coat shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface free from brush marks and all loose particles shall be dusted off. All the cracks, crevices, roughness etc. will be filled with approved putty as per manufacturer's recommendations.
- 13.4** Top Coat: Finishing coats of specified paint of the desired colour & shade shall be applied after the under coat is thoroughly dried. Additional finishing coats shall be applied if found necessary to ensure a proper and uniform semi glossy surface.
- 13.5** Other Details: The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as they are applicable.

14.0 PAINTING WITH ACRYLIC EMULSION/PLASTIC EMULSION PAINT.

- 14.0** This shall be polyvinyl based Acrylic/plastic emulsion paint of approved manufacture of the required shade, conforming to I.S.5411-1969.
- 14.1** Primer: The primer to be used for the painting with acrylic emulsion on cement concrete surfaces, plastered surfaces, A.C. sheets, timber and metal surfaces, if necessary, shall be of approved base and as per recommendations of the manufacturers.
- 14.2** Putty: Plaster filler to be used for filling up (putting) uneven surfaces, small cracks and holes etc. shall be of approved compound and as per recommendations of the manufacturers. No oil based putty shall be used. The putty should be made from a mixture of whiting and plastic emulsion paint or as per manufacturers recommendations.
- 14.3** Finishing coats: All the finishing coats shall be of matt finish or any other finish as required by the Architects. The number of finishing coats shall be as specified in the item.

14.5 MODE OF MEASUREMENT:

- 14.5.1** All the measurements for payment shall be taken on net surface area actually painted, unless otherwise specified. Deduction will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstructions not painted, if they are individually more than 0.05 sqm.

14.6 JOB REQUIREMENTS:

- 14.6.1** Acrylic emulsion paint is required to be provided on plastered and concrete surfaces in portions of the building. The Department shall reserve the option to delete or increase quantities in full or part from the scope of contract during progress of work.
- 14.6.2** All wood surfaces are to be painted with semi glossy synthetic enamel paint with an approved primer.
- 14.6.3** All shades and colours of paints shall be subjected to review and prior approval

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

of Architects and Employer shall be taken before the application.

15 WHITE WASHING WITH LIME

15.5 Preparation of Surface: Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings and foreign-matter.

15.6 In the case of old work, all loose pieces and scales shall be scrapped off and holes in plaster as well as patches of less than 0.05 sqm. area each shall be filled up with mortar of the same mix. Where so specifically ordered by the Architects, the entire surface of old white wash shall be thoroughly removed by scraping and this shall be paid for separately.

15.7 Preparation of lime wash: The wash shall be prepared from fresh stone white lime "Katani" or equivalent. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm. of gum dissolved in hot water, shall be added to each 10 cubic decimetre of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg. of lime.

15.8 Indigo (Neel) up to 3 gm. per kg. of lime dissolved in water, shall then be added and wash stirred well. Water shall then be added at the rate of about 5 ltrs. per kg. of lime to produce a milky solution.

15.9 The lime shall be tested in a chemical laboratory and test certificate submitted, to conform the quality of lime with regard to its physical and chemical properties. The cost of testing lime shall be borne by the contractor.

15.10 White Washing: The white wash shall be applied with brushes or by spray in the specified number of coats. The operation for each coat in the case of brush application shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

15.11 Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Architects before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

15.12 For new work, three or more coats shall be applied till the surface present a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any sign of cracking and peeling nor shall it come off readily on the hand when rubbed.

15.13 For old work, after the surface has been prepared as described here-in- before, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patched do not appear. The washing on ceiling should be done prior to that on walls.

15.14 Protective Measures: Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed shall be protected from being

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splashed upon. Splashings and droppings, if any, shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to painted surfaces, furniture or fittings and fixtures etc. shall be recoverable from the contractor.

15.15 Measurements: All measurements for payment shall be taken on net surface areas actually white washed, unless otherwise specified. Deductions will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstruction not painted if they are individually more than 0.05 sqm. Length and breadth shall be taken correct up to two places of decimal of a metre and areas so worked out shall be correct up to two places of decimals of a square metre.

15.15.1 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area.

| | |
|---|-----|
| Corrugated asbestos cement sheets: | 20% |
| Semi-corrugated asbestos cement sheets: | 10% |

15.15.2 The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.05 sqm. each with materials similar in composition to the surface to be prepared.

15.11.3 Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

16. COLOUR WASHING:

16.5 In the case of colour washing, mineral colours, not affected by lime, shall be added to white wash with proper glue. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Architects and Employer. The colour shall be of even tint or shade over the whole surface. If it is patchy or otherwise badly applied, it shall be redone by the contractor, at no extra cost to the Department.

16.6 For new work, the priming coat shall be of white wash lime or with whiting as specified in the description of the item. Two or three coats shall then be applied as specified on the entire surface till it represents a smooth and uniform finish. Each coat after applying shall be got approved from the Architects.

16.7 The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

16.8 Other specifications as detailed for Whitewashing with lime shall be applicable. Indigo

(Neel) shall however, not be added.

17 DRY DISTEMPERING :

17.5 Distemper: Dry distemper (IS: 427-1965) of approved brand and manufacture, colour and required shade shall be used. The dry distemper shall be stirred slowly in clean water using 0.6 litre of water per kg. of distemper or as specified by the manufacturers. Warm water shall preferably be used. It shall be allowed to stand for atleast 30 minutes before use. The mixture shall be invariably well stirred before

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and during use to maintain an even consistency.

17.6 Preparation of surface: This shall be as for Painting work mentioned here- in-before in so far as it is applicable.

17.7 Application: In case of new work, the treatment shall consist of a priming coat followed by the application of two or more coats of distemper till the surface shows an even colour.

17.3.1 Priming coat: Priming coat of whiting shall be applied over the prepared surface. The whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a thin slurry which shall then be screened through a clean coarse cloth. Two kg. of gum and 0.4 kg. of copper sulphate dissolved separately in hot water shall be added for every cum. of the slurry which shall then be diluted with water to the consistency of milk so as to make a wash ready for use. No white washing coat shall be used as a priming coat for distemping.

17.3.2 The application of each coat as mentioned in the specifications for painting (General) here-in-before, shall hold good, as far as it is applicable.

18 OIL EMULSION (OIL BOUND) DISTEMPERING :

18.5 Oil bound distemper (IS:428-1969) of approved brand and manufacture, colour and required shade shall be used. The primers where used as on new work shall be cement primer or distemper primer as specified in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.

18.6 Preparation of surfaces: The surface shall be prepared as described here- in-before for Painting work in so far as it is applicable and approved putty/ filler shall be applied to the entire area to get uniform and smooth surface before application of primer.

18.7 Application: The cement primer or distemper primer shall be applied by brushing and not by spraying. Hurried priming work shall be avoided, particularly on absorbent surfaces. New plaster patches in old work before applying oil bound distemper shall be treated with cement primer/distemper primer. The surface shall be finished as uniformly as possible leaving no brush marks. Priming coat shall be allowed to dry for at least 48 hours before oil bound distemper is applied. Before applying distemper the surface shall be lightly sand prepared to make it smooth for receiving the oil bound distemper, taking care not to rub out the priming coat. A time interval of at least 24 hours shall be allowed between consecutive coats to permit the proper drying of the preceding coat. Two or more coats of distemper as are found necessary shall be applied over the priming coat to obtain an even shade.

18.8 Other details: The specifications for "Painting (General)" mentioned here-in-before shall hold good as far as it is applicable.

19 WATER PROOFING CEMENT BASED PAINT :

19.5 Material: Cement based paint (IS:5410-1969) of approved manufacture, quality,

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shade and colour only shall be used.

19.6 Preparation of surfaces: The surface shall be thoroughly cleaned off all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing the surfaces. The surface shall be thoroughly wetted with clean water before the water proof cement paint is applied. The prepared surface shall be got approved before painting is commenced.

19.6.1 The water proof cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish.

19.6.2 Water proof cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of water proof cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the water proof cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain liquid of workable and uniform consistency. In all cases the manufacturer's instruction shall be followed meticulously.

19.7 Application: The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun during painting, the cement based paint shall be applied on the surface which is on the shady side. Cement based paint shall not be applied on the surfaces already treated with white wash, colour wash, dry or oil bound distemper, varnishes, paints etc. It shall not be applied on gypsum, wood and metal surfaces.

19.8 Other details: The specifications for Painting (General) mentioned here-in- before shall hold good as far as they are applicable.

19.9 Mode of measurement for dry distemper, oil bound distemper and water proof cement paint: All measurement for payment shall be taken on net surface area actually painted unless otherwise specified and no co-efficient shall be applied for working out areas. Deductions will be made from areas for opening/obstructions not painted, if they are individually more than 0.05 sqm. Length and breadth shall be taken correct up to two places of decimal of a meter and areas shall be worked out correct up to two places of decimal of a square meter.

19.9.1 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentage to allow the girthed area: a) Corrugated asbestos cement sheets - 20%; b) Semi corrugated asbestos cement sheets - 10%.

19.9.2 The number of coats of each treatment shall be stated in the schedule of quantities.

The whole surface shall be applied with approved putty/filler to get uniform and smooth surface at no extra cost to the Department.

19.10 Rates: The rate shall include cost of all materials and labour involved in all the operation described above.

20 BEES WAXING OR POLISHING WITH READY MADE WAX POLISH: (NEW WORK):

20.5 All Furniture Works shall be finished with Laminate internally & externally – No Polish shall be done / used;

20.6 In case of No laminate is used – the same shall be painted appropriately;

21 FRENCH SPIRIT POLISHING: (ON NEW WORK WITH A COAT OF WOOD FILLER):

21.5 All Furniture Works shall be finished with Laminate internally & externally – No Polish shall be done / used;

21.6 In case of No laminate is used – the same shall be painted appropriately;

22 RESIN BASED THERMO PLASTIC PAINT (DECORATIVE AND PROTECTIVE FINISH):

22.5 All Furniture Works shall be finished with Laminate internally & externally – No Polish shall be done / used;

22.6 In case of No laminate is used – the same shall be painted appropriately;

SPECIFICATION FOR METAL FALSE CEILING SYSTEM & THERMAL INSULATION

METAL FALSE CEILING SYSTEM (Armstrong / AMF):

1.0 MATERIALS

1.1 COLOUR: As specified or as approved by the Architects and Employer
Material Description: All components shall be made of aluminium and as per manufacturer's specification.

2.0 METAL CEILING:

2.1 PANEL: The panel shall be cold roll formed panels 150mm wide and 15,5mm deep with a 5mm beveled edge creating an 8mm V groove made from corrosion resistant Al.-Mg. Alloy AA5050, The length of each panel shall be upto 6000mm. The aluminium panels shall be chromatised for maximum bond between metal and paint enameled twice under high temperature, one side with a full primer and finish coat in a polyester paint for a dry film thickness of 20 microns, the other side (inner side) with a primer coating and skin coat on a Continuous Paint Line.

2.2 CARRIER: The carrier on which the panels shall be clipped on to will be 32mm wide, 39mm deep, made of black stove enameled 0.95mm thick aluminium alloy AA5050. When two or more carriers are to be joined, they shall be joined together by means of splices, which will clip on to holes provided for the same.

2.3 WALL TRIM: The wall trim shall be 15mm deep x 30mm wide x 15mm deep x 0.4mm thick Aluminium Alloy AA5050 with square edges and length of 5 mtr.

2.4 ROD HANGER: The rod hanger of suitable length shall be made of 4mm dia. galvanized steel (Zinc coating 120 gms/Sqm.).

2.5 SUSPENSION CLIP: The adjustment suspension clip shall be made of galvanized spring steel V shaped with two holes to accommodate the rod hanger.

2.6 ANCHOR FASTNERS: The single piece sleeve anchor with assembled hanger taper bolt and nut which has smaller driller dia. Anchor fastener shall be of arrow make or equivalent with thread size 5mm.

2.7 SUSPENSION SYSTEM : The carriers would be suspended from the roof by 4mm dia galvanized (Zinc coating 120gms/Sqm.) steel wire rod hangers with height adjustment springs out of galvanized spring steel. Hangers shall be fixed to roof by 'J' hooks and Anchor Fasteners.

2.8 FINISHING OF SURFACE OF STRIPS FOR INTERNAL USE (ALUMINIUM):
The coils from which aluminium panels are made shall be cold roll formed & stove enameled on a continuous coil coating paint line with dried in place roller coated application for pre-treatment. The coils to go through four stages of pre-treatment, three times oven baked through conversion coating, priming and finished coat, ensuring superior adhesion, high corrosion resistance and good colour retention. The coils shall be painted on both sides after being degreased. Prime coat of at least 5 microns to be applied on both sides and a back coat of 5 micron of neutral colour to be applied on the inside surface and 5 micron of binder and 15 microns of top coat of desired colour shall be additionally provided on the exposed surface.

Pencil Hardness : phh > F
Light Fastness : Light fastness of at least 6 according to international wool scale.
Colour Fastness : All finishes shall have a colour fastness of at least 6.
Colour Variation : Colour diff, Bet batches + 4 units Colour diff. Within one batch + 2 units.
Colour Uniformity : Maximum allowable deviation is 2 NBS units. Specular Glose : 10 deg/00 (matt); 25 deg/00 (satin)
Resistance to Salt : After 100 hrs testing under creep from the edges or the Cross, shall exceed 2mm.
Spray Test : Blistering shall not exceed F 8.
Impact resistance : To withstand an impact test of 5mN/mm metal thickness Without loss of adhesion.
Paint adhesion. : Better than or equal rating 1
Humidity : No formation of blister. Resistance.
Chemical : No loss of adhesion or gloss and no colour change or Staining. Resistance.

2.9 FIXING: The panels shall be clipped on to a carrier. The carriers to be suspended with an adjustment spring of galvanised spring steel, V shaped with two holes to accommodate the rod hanger. The rod hanger to be made of 4mm dia, galvanised steel and suspended from the ceiling by J hooks fixed at 1.5mm centre to centre.

2.10 WORKMANSHIP: The ceiling shall be erected in continuous sequence. Spans would not exceed those recommended by M/s. Hunter Douglas India Pvt. Ltd. All work in this section shall be performed in an efficient manner by the installing agency approved by the manufacturers and as per manufacturer's recommended procedures.

2.11 FIRE RESISTANCE: The false ceiling including the paint shall be fire resistant as per DIN 4102. Class A2. It should also be classified as P-NOT EASILY IGNITABLE - AS PER BS 476. Part 6 and should have a fire propagation classification of Class as per BS476. Part 6.

3.0 THERMAL INSULATION:

3.1 UNDERDECK INSULATION:

3.1.1 METHOD OF APPLICATION:

3.1.1.1 Clean the surface and make it free from dust and loose particles.

3.1.1.2 Apply a coat of Shalicoat to the underside of the roof.

3.1.1.3 Apply CPRX compound to the underside of each prelaminated Phenolic Foam panel and press the slabs in position. Butt the joints well together.

3.1.1.4 Secure panel in position with the help of screws, rawl plug and washers.

3.1.1.5 Deal all the joints with the help of self adhesives Aluminium tapes.

.2 INSULATION ABOVE FALSE CEILING:

3.2.1 The insulation tiles shall be placed above the A1 carriers, which are a one meter c/c.

3.2.2 The insulation tiles should be cut to the required size for placement over carriers as Per the spacing and pattern of false ceiling lay out.

3.2.3 The rate quoted shall be inclusive of cutting to the required size, wastage etc.

3.2.4 The tiles shall abut each other to provide a continuous barrier for effective thermal insulation.

3.3 GENERAL:

3.3.1 Extremely low 'K' value 0.018 Kcal/hr M.C.

3.3.2 Low water vapour transmission level.

3.3.3 Should be available in a single component system.

3.3.4 Should be approved by both TAC and NIC.

3.3.5 Should be mildly antiseptic with resistance to fungal and bacterial growth and should not attract rodents/ insects.

3.3.6 Should have good acoustic properties.

3.3.7 Temperature Range: + 125 degrees C to - 190 degrees C.

3.3.8 Material shall be classified as P [not easily ignitable] - BS 476 Part 5.

3.3.9 Material should conform to Building Classification "O" based on the propagation index BS 476 Part 6.

3.3.10 Material shall have a Class I surface spread of flame, the highest rating possible BS 476 Part 7.

3.3.11 Lowest smoke obscuration 5% (almost negligible) - BS 5111 Part 1.

3.3.12 Toxicity index of 0.04478 - Naval Engineering Standards 713 (NES) Ministry.

1 All teak wood shall be of medium seasoned teak, free from sap, knots, cracks and shall be of lighter grains and shall be of Honsur / Shimoga / Ballarshaw or of approved range. If required, teak wood shall be tested in laboratories at

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Contractors expenditure. All sal wood shall be seasoned, free from sap, knots, cracks and as per approved sample.

- 2 All teak wood, plywoods and any other wood used in the work shall be **coated with approved quality anti-termite** i.e. Touch wood or approved equivalent type. at site with a test certificate at contractors expenditure.
- 3 All door shutters shall be fitted with normal approved fittings as mentioned above.
- 4 All screws shall be machine made and of Nettle fold / GKW make or of approved equivalent make.
- 5 Even if it is not mentioned in the specifications / drawings, it should be clearly understood that all open edges of fitted plywood (i.e. door, cup board, shutter, drawers etc.) shall be provided with teak wood beadings. All teak wood beadings shall match laminate shade or in approved finish.
- 6 The rate quoted in all the items shall include the cost of all fixtures, materials, manufacturing, transportation, installation, sales tax and other taxes if any etc. All partitions / paneling shall have provisions for conducts of electricity/ telephone/computer / audio- visual / Fire alarm / Intercom etc.
- 7 No work shall be executed at the site without prior approval of samples of all parts.
Note: Regarding the availability of the material and that only materials called for under fiWWW preference shall be supplied and installed. In the event of the materials of make called for are not available and alternative makes are approved for incorporation in the work, the rates quoted shall be suitable amended bases on the price variation between the specified marks and alternative makes on the day the alternative makes are accepted.

8 **MAXIMUM MOISTURE CONTENT FOR WOOD WORK**

A) Thinner than 50 MM 10 % average moisture content of given lot + 2% & furniture and cabinet 12 % moisture content of individual Sample + 3 % making of the maximum permissible moisture content.

9. **PLYWOOD :**

A) Board formed of three or more layers of veneer cemented or glued together, usually with the grain of adjacent veneers running at right angles to each other. The veneers for all grades shall be either rotary out or sliced. The veneers shall be sufficiently smooth to permit even spread of glue. The thickness of all veneers shall be uniform; within a tolerance of 5 % corresponding veneers on either side of the center on shall be of the same thickness and spacaties. The requirements of thickness of face and core veneers shall be as follows:

- a) In 3-Ply boards up to 5 mm thick, the combined thickness of the face veneers shall not exceed twice the thickness of center ply.
- b) In a multiply boards, the thickness of any veneers shall not be more than thrice the thickness of any other veneer.
- c) The sum of the thickness of the veneers in the one direction shall approximate to the sum of the thickness of the veneers at right angles to them and shall not be greater than 1.5 Times this sum except for 3 – ply as specified in (A)

**THE THICKNESS OF PLYWOOD SHALL BE SPECIFIED AS UNDER:
BOARD THICKNESS**

- 9 MM
- 12 MM
- 15 MM
- 16 MM
- 19 MM

22 MM
25 MM

PLY WOOD ADHESIVE:

The adhesive used in plywood shall be Phenol – Formaldehyde Resin of B.W.R. Grade conforming to IS: 848.

MARINE PLYWOOD :

Marine plywood shall be as per IS : 710.

10: GYPSUM FALSE CEILING:

Providing and fixing at all height false ceiling of 12.5 mm thick tapered edge gypsum board conforming to IS: 2095 including providing and fixing of frame work made of special sections power pressed from M.S. sheet and galvanized in accordance with zinc coating 600 as per IS: 277 and consisting of angle cleats of size 25 mm wide X 15 mm thick with flanges of 22 mm and 37 mm at 1200 mm centre to centre one flange fixed to the ceiling with dash fastner 12.5 mm dia X 40 mm long with 6 mm dia. Bolts to the angle hangers of 25 X 25 X 5 mm of required length, and other end of angle hanger being fixed with nuts and bolts to 6.1 channels 45 mm X 15 mm X 0.9 mm running at the rate of 1200 mm centre to centre to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having clips of 10.5 mm at 450 mm centre to centre shall be fixed in a direction perpendicular to 6.1 channel with connecting clips made out of 2.64 mm dia. X 230 mm long 6.1 mm wire at every junction including fixing the gypsum board with ceiling section and perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre to centre with 25 mm long drive – all screws @ 230 mm interval including joining and fixing to a flush finish of tapered and square edges of the gypsum board with recommended filler, paper tapes, finished and two coats of primer suitable for gypsum board as per manufacturers specification and also including the cost of making openings for light fittings, grills, diffusers, cut outs made with frame of perimeter channels suitably fixed finishing of all joints neatly to proper line & level including providing of additional framework for electricals fixtures including giving trap doors where ever required. Diffusers, cutouts for fire sprinklers etc. as per the specifications approved by architects including necessary scaffolding supports, suspenders etc. All complete as per drawing and specification and direction of the architect.

11. Wooden ceiling

Providing and Fixing Wooden Ceiling Made out of 12mm MR Grade Commercial plywood with necessary framing structure from true slab Hanging with 3 mm SS adjustable wire from ceiling with 's' hook. Ceiling is to be finished with 4mm Approved veneer with necessary grooves and finish the same with 1 coat of sealer, 3 coats of melamine polish. Complete as per architects details.

12. Fabric stretch ceiling

Pvc Stretch Fabric with Wood Fibre Framework, Edison Led inside & AIBRA Transformer; Installation of Stretch Ceiling by Professional Installer

OSC-Premium-EU Translucent-1111 Premium White Translucent Stretch Ceiling Membrane Includes :Supply of Premium Stretch Ceiling of mentioned make list with model (OSC-Premium-EU Translucent-1111) Custom made demountable stretch ceiling to fit exact dimensions with premium aluminium grippers. The ceiling must be stretched and hooked into premium aluminium grippers insuring good rigidity. A pvc hook for tension

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mounting is welded on the outline of the ceiling membrane with all new and updated HF technology

4000k Natural / Day Light White LED Module Lighting with SAMSUNG chip for long life lighting. Includes : Supply of 4000k Natural / Day Light White SAMSUNG chipped Module Lighting with compatible non dimmable driver. Warranty: 2 years on driver & 5 years on LED Lighting. Lights to be placed in such a manner that no dark patch appears or zebra pattern appears. Once lights are installed stretch ceiling to give uniform output with required lux level as per architect / lighting consultant

TECHNICAL SPECIFICATIONS OF PAVIT BLOCK

SPECIFICATIONS

PACKING DETAILS

| Size (cm) | Thickness (mm) | Tiles / Box | Sqm/Box | Approx. Weight / Box (Kg) |
|-----------|----------------|-------------|---------|---------------------------|
| 60x120 | 20 | 1 | 0.72 | 31 |
| 60x90 | 20 | 1 | 0.54 | 23 |
| 60x60 | 20 | 2 | 0.72 | 31 |

TECHNICAL SPECIFICATION HEAVY DUTY OUTDOOR PORCELAIN PAVERS.

| S. No. | Property | Group Bla : ISO 13006 - 2018 | Group Bla IS :15622:2017 | Kajaria X- Stone Value | Test According to |
|--------|---|--------------------------------|------------------------------------|------------------------|-----------------------------|
| | Dimensions & surface Quality | | | | |
| 1. | Deviation in length and width | ± 0.3% | ± 0.1% | ± 0.1% | ISO 10545:2/IS:13630 (P-1) |
| 2. | Deviation in thickness | ± 5% | ± 4% | ± 4% | ISO 10545:2/IS:13630 (P-1) |
| 3. | Deviation in Straightness of sides | ± 0.3% | ± 0.4% | ± 0.1% | ISO 10545:2/IS:13630 (P-1) |
| 4. | Deviation in Rectangularity | ± 0.3% | ± 0.1% | ± 0.1% | ISO 10545:2/IS:13630 (P-1) |
| 5. | Deviation in Surface Flatness | ± 0.4% | ± 0.50% | ± 0.2% | ISO 10545:2/IS:13630 (P-1) |
| 6. | Surface Quality (%) | Minimum 95% | Minimum 95% | No visible defects | ISO 10545:2/IS:13630 (P-1) |
| | Physical characteristics | | | | |
| 7. | Scratch Hardness of surface Moh's scale | Required | Min. 5 | Min. 8 | IS:13630 (P-13) |
| 8. | Water absorption | ≤0.5% Individual maximum 0.06% | Average ≤0.08, Individual 0.10%max | <0.08 % | ISO 10545:3/IS:13630 (P-2) |
| 9. | Moisture Expansion | Test method available | Max 0.02 mm/m | Max 0.01 mm/m | ISO 10545:10/IS:13630(P-3) |
| 10. | Surface abrasion | Required | Min Class - 2 | PEI class 4 - 5 | ISO 10545:7/IS:13630 (P-11) |
| | Mechanical characteristics | | | | |
| 11. | Breaking strength | 1300 N | Min 1300 N | ≥7000 N | ISO 10545:4/IS: 13630 (P-6) |
| 12. | Modulus of rupture | >35 N/mm ² | Average 35, Individual minimum 32 | ≥45 N/mm ² | ISO 10545:4/IS: 13630 (P-6) |

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| Safety characteristics | | | | | |
|--|--|--|-----------------------|-------------------------|-------------------------------|
| 13. | Density | Min 2.20 gm/cc | Min 2.20 gm/cc | > 2.25 gm/cc | ISO 10545:3 /IS:13630 (P-2) |
| 14. | Impact resistance (Coefficient of restitution) | Test method available | Min 0.55 | > 0.80 | ISO 10545:5/IS:13630 (P-14) |
| 15. | Co-efficient of Friction (Anti slip test) " RAMP TEST | Test method available | Test method available | R -11 | DIN 51130:2014 |
| Thermo photo characteristics | | | | | |
| 16. | Thermal shock resistance | Test method available | Min 10 cycles | Pass min 10 cycles | ISO 10545:9/IS: 13630 (P-5) |
| 17. | Co efficient of thermal expansion | 9×10-6 Max | 6×10-6 Max | <6×10-6 | ISO 10545:8/IS:13630 (P-4) |
| 18. | Crazing Resistance | Required | 4 Cycle Pass | 4 Cycle Pass | ISO 10545:11/IS:13630 (P-9) |
| 19. | Frost resistance | Required | Required | No Damage | ISO 10545:12/IS: 13630 (P-10) |
| 20. | Small colour differences | Plain coloured tiles only where required $\Delta E_{cmc} < 0.75$ | - | No differences | ISO 10545:16 |
| Chemical characteristics characteristics | | | | | |
| 21. | Stain Resistance | Min Class - 3 | Min class - 1 | Min conform to class-4* | ISO 10545:14/IS:13630 (P-8) |
| 22. | Chemical Resistance HOUSE HOLD CHEMICAL & SWIMMING POOL SALT | Min class-GB | Class - AA | Conform to classes-GA* | ISO 10545:13/IS:13630 (P-8) |
| 23. | Chemical Resistance LOW CONCENTRATIONS ACID & ALKALIES | Manufacturer is to state classification | Required | Conform to classes-GLA* | ISO 10545:13/IS:13630 (P-8) |
| 24. | Chemical Resistance HIGH CONCENTRATIONS ACID & ALKALIES | Test method available | Required | Conform to classes-GHB* | ISO 10545:13/IS:13630 (P-8) |

- Skid resistance value can be provided according to test method used & surface finish, also area of use.
- 20 mm tiles have resistance to most of the stains/chemicals but it is recommended to take due care while laying and for day-to-day maintenance.
- We recommend to cover the surface with polythene sheet or any other suitable source before any wall or furniture painting work starts so that beauty of slab surface remains forever.
- Resistance to acids & alkalies (Exception Hydrofluoric acids & its Compounds)

SPECIFICATIONS FOR DISMANTLING AND DEMOLITION

SCOPE OF WORK:

The work envisaged under this sub-head is for dismantling and demolition of brick masonry in cement/lime mortar, reinforced cement concrete works, removing wooden chowkhats of doors, wooden or steel windows.

1.0 GENERAL:

The term Dismantling implies carefully taking up or down and removing without damage. This shall consist of dismantling one or more parts of the building as specified or shown on the drawings.

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

The term Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on drawings.

2.0 PRECAUTIONS:

Necessary propping, shoring and/or underpinning shall be provided for the safety of the adjoining work or property, which is to be left in tact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property.

Wherever required, temporary enclosures or partitions shall also be provided.

Necessary precautions shall be taken to keep the dust- nuisance down as and when necessary

Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roofs, masonry etc., shall be carefully dismantled first. The dismantled articles shall be passed by hand where necessary and lowered to the ground and not thrown. The materials then be properly stacked as directed by the Employer.

All materials obtained from dismantling or demolition shall be the property of the Employer unless otherwise specified and shall be kept in safe custody until handed over to the Employer.

Any serviceable material, obtained during dismantling or demolition shall be separated out and stacked properly as indicated by the Employer within a lead of 150 m. or as specified in the item. All under serviceable materials, rubbish etc. shall be disposed off as directed by the Employer and Bank.

3.0 TREATMENT:

All the dismantled area shall be rendered clean off all debris, dust etc. The sides of jambs, sills, soffits etc. of the openings if any, after taking out doors and window chowkhats, unless and otherwise to be treated, shall be plastered in C.M. 1:3 with neeru finish to render true sides, corners, edges etc.

4.0 MODE OF MEASUREMENT:

4.1 Brick Masonry & R.C.C. Works: The measurement of brick masonry with or without plaster/ painting shall be taken correct to a centimeter and volume calculated in cubic metres up to two places of decimal.

4.2 Doors and Windows: Dismantling of doors and windows (wooden or steel) shall be enumerated. Removal of chowkhats (frame works) shall include (unless otherwise separately mentioned for removing shutters only), the removal of shutters along with architraves, beadings, fittings and fastenings along with frames.

5.0 RATES:

The rate shall include cost of all such operations mentioned above including necessary labour, materials, transport, scaffolding, stacking the serviceable materials, disposing the unserviceable materials within the lead specified, all as directed by the Architect and Employer.

1.7 ROLLING SHUTTERS, STEEL DOORS, M. S. WINDOWS:

M.S. Door frames:

The M.S. Door framing shall be fabricated as shown in drawing and fabricated with necessary stiffeners, hinges, holdfasts, etc. as per the drawings/sketches attached with the tender. The contractor shall quote the rate taking into account all the above requisites, including the width of frame and erecting at site in line, level, plumb, etc. and with one coat of shop paint of Red Oxide Primer. The metal door shall be stored under cover to prevent damage or distortion when taking delivery of items supplied by owner, the Contractor shall satisfy himself that the items supplied are up to the specified standard. Any defect detected shall promptly be brought to notice of Architect/Consultant/Owner/Employer.

The work shall have to be done in co-ordination with other agencies working at site.

Rolling Shutters:

The specifications shall be generally as per the manufactures one. However, the following may be noted. The M.S. laths for rolling shutters shall be 20 gauge and the type of rolling shutter shall be pull and push type. The workmanship should be of first-class quality. The springs and other materials shall be of best quality. The vertical guides shall be straight and of pressed type and the shutters shall be sizes to suit the requirements of this tender.

M.S. Windows and Ventilators:

All windows shutters shall be fabricated to correct shape and size as per drawings approved by Company. However, before fabricating any item the contractor has to check the opening dimensions at site. Any discrepancy therein shall be brought to Company's notice in writing mentioning the particular windows. Steel windows shall conform IS:1038 & IS:1361.

All sections for windows shall be extruded sections of approved quality. All extruded sections shall be of 14 gauge. Z sections shall be of 10-gauge sheet.

All glasses shall be standard glazing quality clear sheet glass and free from waves, specks, disfigurements or blemishes of any kind. All glasses shall be accurately cut and fitted with glazing clips or as directed by Company. The thickness of the glass will be as per the specification mention in the Bill of Quantities. Glass should be fixed in the frame with best quality putty of required thickness.

The contractor shall have to make all necessary holes in concrete masonry for fixing of windows. The contractor shall also fix and grout the shutter in line and level with his own masons.

The steel members shall be given a coat of approved anti-rust paint.

Hardware:

Peg stay arms, handles, hinges etc. shall be of approved quality and details.

Fixed or openable panels of the windows shall be as shown in the drawing.

Measurement:

The rate quoted by the contractor under each item in the Bill of Quantities for a complete finished item of and no claims by the contractor in this regard shall be admissible. Supplying

and fixing of all the fittings and iron monger shall be deemed to have been included in contractor's rates and consequently, shall not be paid for separately.

The form work and scaffoldings shall be deemed to have been included in the rates quoted by the contractor and shall not be paid for separately for any of the items.

1.8 CEMENT PLASTERING (INTERNAL & EXTERNAL):

The Cement plaster shall be 6mm, 12mm or 20mm or any thickness as specified in the item.

Scaffolding:

For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other brick work in buildings, single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/ columns less than one meter in width, or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Preparation of Surface:

The Joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scraping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

Application of Plaster:

Ceiling plaster shall be completed before commencement of wall plaster.

Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and true surface, plaster about 15 x 15 cm. shall be first applied, horizontally and vertically at not more than 2m. intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one meter long to ensure thorough filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and sideways movements at a time. Finally, the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowel in or over working the float shall be avoided. During this process, a solution of like putty shall be applied on the surface to make the later workable.

All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, junctions etc. where required shall be done without any extra payment. Such rounding or chamfering shall be carried out with proper templates to the sizes required.

In suspending work at the end of the day, the plaster shall be left, out clean to line both horizontally and vertically, when recommencing the plastering, the edge of the old work shall be scraped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm. to any corners or arises. It shall not be closed on the body of the features such as plasters, bands and cornices nor at the corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings, as these invariably lead to leakages.

No portion of the surface shall be left out initially to be patched up later on.

Finish:

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5m. long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs corners with a plumb bob as the work proceeds.

Thickness:

The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e. grooves or open joints in brick work. The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than specified thickness by more than 3mm.

The average thickness should be regulated at the time of plastering by keeping suitable thickness of the gauges. Extra thickness required in dubbing behind rounding of corners at junctions of wall or in plastering of masonry cornices etc. will be ignored.

Curing:

Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Architect/Consultant/Owner/Employer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

Precaution:

Any cracks which appear in the surface and all portions, which should hollow when tapped or are found to be soft or otherwise defective, shall be cut out in rectangular shape and re-done as directed by Architect/Consultant/ Owner/ Employer.

1.9 CEMENT PLASTER WITH A FLOATING COAT OF NEAT CEMENT:

The cement plaster shall be 6mm. 12mm or 20mm thick, finished with a floating coat of neat cement as described in the item.

When the plaster has been brought to a true surface with the wooden straight edge it shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that the whole surface is covered with neat cement slurry 1.5mm thick while the plaster surface is still fresh. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour adding water to the plaster mix.

Structural Steel Work and Asbestos Work:

Structural Steel Work:

The work covered by this contract comprises the supply, fabrication and erection of structural steel work in accordance with the drawings, furnished by Company and as directed in the Bill of Quantities and Specifications hereinafter.

The static calculations shall be worked out by Company. The current rules and practices set forth in the latest Indian Standards for materials, fabrication and erection of structural steel work including metal are welding shall be strictly followed unless otherwise indicated hereinafter.

In case the Contractor wishes to suggest certain alterations substitutions or modifications of design, sections, details, etc. he shall provide the necessary drawings therefore together with calculations and details. These details shall be checked by Company and approved.

It is intended that the drawings and specifications include everything requisite and necessary to finish the work properly notwithstanding the fact that every time may not be specifically mentioned. All supplementary parts such as bolts, clips and angles necessary to complete each item shall be deemed to be included though not specifically stated. All work when finished shall be delivered in a complete and undamaged state.

Materials:

All material (such as structural, steel, rivet steel and electrodes) required for the work shall be best tested quality conforming strictly to the relevant Indian Standard Specifications. Materials shall be free from scale, blisters, Laminations cracked edges and other defects.

Workmanship (Fabrication):

All workmanship shall be first quality in every respect, greatest accuracy being observed to ensure that all parts will fit together properly on erection.

All ends shall be cut true to fit the abutting surfaces accurately. Butt ends of compression members shall be in close contact through the area of the joint. Stiffeners, if any, shall bear tightly at both ends.

Shop Drawings:

The Contractor shall submit 3 sets of shop and erection drawings with erection sequence necessary for the construction for approval of Company free of charge. No fabrication work shall be undertaken until the written approval is obtained from Company. The approval of drawings by Company, Indicates only the general method of construction and that the detailing is satisfactory. Approval of such drawings shall not relieve the contractor of the responsibility for any errors or compliance with the requirements of contract, plans and specifications. The contractor shall be responsible for the dimensions and designs of adequate connections, supports, details and satisfactory construction of the work.

Welding:

Welding shall be permitted to be carried out by licensed welders. All welding work shall be fillet welds in general and shall strictly conform to the relevant Indian Standards. The diameter of the electrodes, the throat thickness of the weld, etc. shall be as per Standard Practice or as directed.

Riveting:

Where necessary shall be Machine riveting and shall be carried out all as laid down in the relevant Indian Standards.

Shop Erection:

If so directed, the fabrication steel work shall be shop erected to check the accuracy of fit and fabrication.

Erection and making at Site:

During erection, the work shall be securely braced and fastened temporarily to provide safety for all erection stresses at. No. permanent bolting or riveting or welding shall be carried out until proper alignment has been obtained.

Painting:

a) Shop Coat:

All Steel work shall be properly cleaned of all loose mill scale, rust, dirt and other foreign matter. Except where encased in concrete and surface area adjacent to edges to be field welded all steel work shall be given one coat of approved anti-rust (Red Oxide) well worked into the joints. All paint shall be applied to dry surfaces.

b) Inaccessible Parts:

Parts inaccessible after assembly shall be given two coats of shop paint of different shade No spots of bottom coat shall show through.

c) Contact surface:

All contact surfaces shall be properly cleaned by effective means but not painted.

d) Surface to be filled welded:

Surfaces which are to be welded after erection shall where practicable not receive a shop coat of paint. If painted, such paint shall be removed before field welding for a distance of at least 50mm on either side of the joint.

Measurements:

The measurements shall be as per the final fabrication drawings. Payment shall be made on the actual tonnage erected. The rate quoted shall be inclusive of welding, riveting or bolting and grouting bolts. The latest code of practice of Indian Standard Institution for Method of Measurement purposes.

Asbestos Work:

Scope of work:

The work under this contract comprises of the following:

- a) A.C. Sheet Roofing with accessories
- b) A.C. Gutters with accessories

c) A.C. Sheet Cladding.

Materials:

Asbestos Cement Sheets for roofing, cladding and A.C. rain water gutters shall be procured from the approved manufacturer.

Roofing and cladding shall be carried out with "Corrugated Sheets".

Workmanship:

Workmanship shall be strictly in accordance with the Code of Practice issued by Asbestos Cement Co. and will conform with the drawings and instructions issued by Consultants.

A.C. Sheets for roof and cladding will be procured in the specified sizes so as to minimize the wastage.

Corrugated sheets in roof shall be laid from right to left. The first sheet shall be laid uncut but the remaining sheets in the bottom shall have the top right and corners cut of miters. The sheets in the second and other intermediate rows shall have the bottom.

Wherever four sheets met at a lap, two of them shall be mitered to provide a snug fit. The length of mitre shall be 20 cm. width equal to the width of the corrugation. Mitering shall be done with an ordinary wood saw.

The ends of all sheets at the eaves shall be supported and the support shall be placed as near to the margin of the sheets as practicable.

Cat ladders or roof boards shall be used when working to avoid damage to the sheets and to provide security to workmen. These shall also be used when fixing roofing accessories, gutters and accessories.

Corrugated sheets shall be laid with smooth side upwards. End mark 'Top' on the smooth side always point the ridge. End lap in sheets shall be 20 Cm. and side lap shall be on one corrugation, the left-hand small corrugation of each sheet being covered by the right hand large corrugation of the next sheet.

Holes in A.C. sheets for fixing shall be 11.11 mm (7/16") dia drilled never punched, in the crown of the corrugation. Fixing bolts, screws shall be 7.94mm (5/16") dia and all fixing accessories including nuts and washers shall be galvanized iron. "Everest" bitumen washer shall be screwed lightly at first and lightened when a dozen or more sheets are laid screwing the sheets down too lightly on the purlins will be avoided. Every vertical side lap corrugation will carry a fixing accessory also as the urges and also through one of the two intermediate corrugations on each sheet. When the sheets are supported one intermediate purlin as in the case of lengths over (1.83m) and additional fixing accessory shall be provided through each side lap corrugation only.

A.C. gutter shall be supported along its girth through its length by adjustable brackets fabricated out of suitable M.S. straps at approx. 45 cm. c/c fabricated to the same profile as the gutter is fixed to the adjacent M.S. tuners/purlins by suitable M.S. accessories.

Gutters and accessories to be joined shall be perfectly dry and clean. Asbestos ropes 6.35mm (1/4") dia smeared with "Everest" bitumastic jointing compound shall be placed on both sides of the union clip, 1.25cm. inside from the edge along its inner cutout.

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The space between the ropes shall be filled with "Everest" bitumastic jointing compound and levelled uniformly with a piece of wood or the edge of a trowel to the height of the rope.

Gutters and accessories shall be placed in position with 1.59mm (1.16") dia space between the butt joints and the prepared union clip shall be fixed underneath the butt joint.

From the inside the gutter 7.94mm (5/16") dia. G.T. Seam bolts shall be inserted in the ready drilled holes with an "Everest" bitumen washer adjacent to the gutter and a G.T. flat washer in top of it and shall be screwed with a nut.

The bolts shall be so positioned that "Everest" bitumen washers shall be correctly centred on the holes in the gutter as also in the union clip.

Over tightening of nuts shall be avoided to prevent sheets from cracking.

After a complete gutter line has been fixed in position all brackets supporting the gutter shall be adjusted to give the required slopes towards the gutter outlets.

Gutter line shall be tested for water tightness after jointing. All outlets shall be plugged and the entire length of the gutter line filled with water and retained these for 24 hours for observations.

Measurements:

The sloping area of roof coverings and claddings as laid shall be measured in square meters without allowance for laps and corrugations, if any.

Portions of roof covering overlapped by ridge or hip etc. shall be included in the measurements of the roof.

Any opening not exceeding 0.4 Sqm. shall not be deducted and forming such openings requiring cutting shall be enumerated.

Any opening exceeding 0.4 Sqm. shall be deducted and cutting required shall be measured in running meter.

WOOD COMPOSITE DOOR/FRAME WORKS

WPC FRAMES: The factory made single extruded WPC (Wood Polymer Composite) solid door/window/Clerestory windows & other Frames/Chowkhat comprising of virgin PVC polymer of K value 58-60 (Suspension Grade), calcium carbonate and natural fibers (wood powder/ rice husk/wheat husk) and non toxic additives (maximum toxicity index of 12 for 100 gms) fabricated with miter joints after applying PVC solvent cement and screwed with full body threaded star headed SS screws having minimum frame density of 750 kg/cum, screw withdrawal strength of 2200 N (Face) & 1100 N (Edge), minimum compressive strength of 58 N/mm², modulus of elasticity 900 N/mm² and resistance to spread of flame of Class A category with property of being termite/borer proof, water/moisture proof and fire retardant and fixed in position with M.S hold fast/lugs/SS dash fasteners of required dia and length complete as per direction of Engineer-In- Charge. (M.S hold fast/lugs or SS dash fasteners shall be paid for separately).

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Note: For WPC solid door/window frames, minus 5mm tolerance in dimensions i.e depth and width of profile shall be acceptable. Variation in profile dimensions on plus side shall be acceptable but no extra payment on this account shall be made.

WPC DOORS: The factory made single extruded WPC (Wood Polymer Composite) solid plain flush door shutter of required size comprising of virgin polymer of K value 58-60 (Suspension Grade), calcium carbonate and natural fibers (wood powder/ rice husk/wheat husk) and non toxic additives (maximum toxicity index of 12 for 100 gms) having minimum density of 650 kg/cum and screw withdrawal strength of 1800 N (Face) & 900 N (Edge), minimum compressive strength 50 N/mm², modulus of elasticity 850 N/mm² and resistance to spread of flame of Class A category with property of being termite/borer proof, water/moisture proof and fire retardant and fixing with stainless steel butt hinges of required size with necessary full body threaded star headed counter sunk S.S screws, all as per direction of Engineer-In-Charge. (Note: stainless steel butt hinges and necessary S.S screws shall be paid separately)

UNPLASTICIZED POLY-VINYI CLORIDE (uPVC) WORKS

The factory made uPVC glazed/wire mesh windows/doors comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler (where ever required) extruded profiles having minimum wall thickness of 1.70 mm for Series R1 and R2 profiles and 2.10 mm for Series R3 and R4 profiles conforming to EN: 12608 in any shape, colour and design duly reinforced with galvanized mild steel section made of required shape & size as per CPWD Specification, uPVC

extruded glazing beads, interlocks and Inline sash adaptor (where ever required) of appropriate dimension, EPDM gasket, hardware, SS 304 grade fasteners of minimum 8 mm dia with countersunk head, comprising of matching polyamide PA6 grade sleeve for fixing frame to finished wall as per IS 1367 : Part 1 to 14, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame, sash & mullion (if required) shall be mitred cut and fusion welded/mechanically jointed duly sealed at all corners, including drilling of holes for fixing hardware and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of approved size and quality, all complete as per approved drawing conforming to CPWD specification & direction of Engineer-in-Charge. Section of steel reinforcement and cross sections of uPVC profiles to be as per design approved by Engineer-in-Charge.

Wire mesh / Glazing of plain/ toughened/ laminated/ double glass unit with / without high performance coatings as per design requirements and conforming to IS: 3548 & IS: 16231 shall not be paid separately, window with frame, glazing necessary hardware shall paid as one item.

Note:- Structural design proof checked from a Government Engineering Institute, to be provided by the manufacturer for :

- (i) Sites with basic wind speed > 45 m/sec as per IS 875 — Part 3
- (ii) Sites with structure height more than 20m for all wind speeds

LIST OF MATERIALS OF APPROVED BRAND AND MANUFACTURE

| No | Item | Approved make |
|----|---|---|
| 1 | Cement (PPC) | Ultratech (Super), OCL, Dalmia DSP, ACC, Lafarge |
| 2 | RMC | Ultratech RMC, Duramix, Kalinga RMS, RDC, Nuvoco RMC as approve by Engineer in charge/Architect |
| 3 | Sand (coarse and fine) | Locally available good quality river sand |
| 4 | Brick (Fly ash) | Locally available good quality bricks |
| 5 | Steel (TMT FE 500 grade) | TATA TISCON 500SD /SAIL TMT EQR 550 /JINDAL PANTHER 550D/VIZAG STEEL |
| 6 | Floor and wall tiles (ceramic/Vitrified) | Somany, Johnson, Kajaria, NITCO, Somany, Simpolo |
| 7 | Tile Adhesive | Sika, Fosroc, MYK Laticrete, Bal ndure /Roff |
| 8 | Construction Chemicals | Sika/Fosroc/MYK Laticrete/Dr Fixit/ Roff |
| 9 | Paints, putty, primer (Exterior and interior) | Berger, Asian, ICI |
| 10 | Glass | Saint gobain/ Modi/Tata/Asahi |
| 11 | Concrete Cover | Astra/ equivalent |
| 12 | Flush door | Century/Sylvam/Green/Austin |
| 13 | AAC Block | Ultractech/Fast build block/ ABSS construction/ equiv as approved |
| 14 | WPC door & frames | Duroplast/Alstone/JAISHREE/FENESTA) |
| 15 | uPVC windows & frames | Duroplast/Fenesta//Prominence/Saint Gobain |
| 16 | HPL | FunderMax / Trespa / RHEAU |
| 17 | GI sheet/Angles | JINDAL/TATA/SAIL |
| 18 | STAILESS STEEL | JINDAL/SALEM-SAIL/TATA |
| 19 | Water Proofing Compound | Pidilite/Sika/Fosroc/Dr.Fixit |
| 20 | Aluminium section | Hindalco/ Jindal/OEL |
| 21 | Plywood | Green-ply / Century Ply/ Austin Ply/Mikasa |
| 22 | Laminate | Green/Century/Merino/AICA |
| 23 | Wallpaper | Asian Paints(Nilaya collection)/ Ddecor/Excel/Krshna Mehta |
| 24 | Blinds | Vista/Marvel/Pristine |
| 25 | Hardware | Dorset / Hafele /Hettich |
| 26 | Pavit | Pavit/Johnson/Nitco/Kajaria/Qutone/Simpolo |
| 27 | Carpet Flooring | Ecosoft/Milican/Welspun |

Volume – II
TECHNICAL SPECIFICATIONS
FOR
PUBLIC HEALTH WORKS

TECHNICAL SPECIFICATIONS FOR SANITARY FITTINGS

- 1.0 SANITARY WARES AND ALLIED FITTINGS.** All sanitary wares with their allied fittings must be first quality (best) of approved make and brand.
- 2.0 SQUETTING PATTERN W.C. PAN (INDIAN TYPE):** The W.C. Pan shall be of white vitreous China of specified size and pattern (Orissa or long pattern as specified) with an integral flushing rim. It shall have the flushing horn in the back unless it is not possible to accommodate cistern to suit this design. The pan shall be of approved quality. It shall have 100 mm. C.I. or porcelain trap 'P' or 'S' type with minimum effective seal of 50 mm. and 50 mm. vent arm.
- 2.1 FIXING OF W.C. PAN:** The squatting type W.C. pan shall be sunk in floor sloped towards the pan in a workmanship like manner, care being taken not to damage then pan in the process of fixing. It damaged in any way it shall be replaced at contractors' cost. It shall be fixed on a proper cement concrete base of 1:3:6 proportion taking care that the cushion is uniform and even without having any hollows between the concrete base and pan and finished just below level of rim of pan to receive the specified thickness of the floor finishing. No extra for concrete bed shall be paid for.

The joint between the pan and the trap shall be made with cement mortar 1:1 and shall be leak proof.

- 3.0 PEDESTAL WASH DOWN SYPHONIC (SINGLE OR DOUBLE TRAP) WATER CLOSET (EUROPEAN TYPE):** The W.C. Pan shall be of white vitreous chine unless otherwise specified of one piece construction of wash down type with integral 'P' or 'S' trap as required. It shall be of approved quality and pattern.
- 3.1 INSTALLATION:** The weight of the fixture and user are supported on the floor and not on the drainages pipe and this should be done in standard approved method.
- 3.2 SEAT AND COVER:** The double solid seat with lid shall be of well-seasoned teak wood varnished or mahogany polished or plastic seat as specified with rubber buffers and shall be fixed in position by using chromium plated brass hinges and screws. The seat shall be nonabsorbable and free from cracks and crevices in the materials. The plastic seat and cover, where specified, shall conform to I.S. specifications and shall be of white color unless otherwise specified.
- 4.0 FLUSHING:** The flushing of the squatting and pedestal W.C. pan shall be done by low level valve less symphonic flushing cistern of approved quality and capacity as specified. In the former case the connection between the flush pipe of the cistern and W.C. pan shall be made by Rigid PVC pipe connection as specified. The other specification will be as for squatting pattern W.C. pan.

The flush pipe shall be fixed to wall by using holder bat clamps or embedded as required.

As specified low level Cisterns of specified capacity shall be fitted with all internal fittings brackets and C.P. brass flushing handle, and connected to the W.C. pan by means of 40 mm. diameter chromium plated brass bend and rubber or any other as specified.

- 4.1 BRACKETS:** The cistern shall be fixed on cast Iron or rolled steel cantilever brackets of required strength which shall be firmly embedded in the wall or fixed by using

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wooden plug and secret, to the satisfaction of the Consultant/Employer. Depending on the quality of work and type of sanitary fixtures, the fixing of cistern should vary in quality of materials and design also. Or it may be installed in other ways like placing on the top at the back of the W.C.

- 4.2 OVERFLOW:** The cistern shall be provided with 20 mm. pipe with fittings which shall terminate into mosquito proof coupling secured in a manner that will permit it to be readily cleansed or renewed, when necessary.
- 4.3 FLUSH PIPE.:** Unless otherwise stated in the schedule of quantities, the outlet or flush pipe from the low level cistern shall be of 40 mm. Rigid PVC/Brass chromium pipe minimum thickness of 2.6 mm. as specified or P.V.C. pipe as required by the Consultant/Employer which shall be connected to the W.C. pan by means of an approved type of joint adapts. The flush pipe shall be fixed to wall by using holder bat clamps or embedded as required.
- 4.4. PAINTING C.I. CISTERN:** Inside of cisterns and fittings shall be painted with approved bituminous paint and outside of the cisterns, if required, brackets, overflow and flush pipes, if required, etc. shall be painted with two coats of synthetic enamel paint of approved shade and make to given an even appearance. The cost of such painting shall be included in the rate quoted for the flushing cistern.
- 5.0 STANDING URINALS:**
- 5.1 BOWL URINAL:** The urinal shall be flat back or angular pattern lipped front basin of required dimensions of white vitreous china and one piece construction with internal flushing box rim of an approved make as specified. It shall be fixed in the position by using wooden plug embedded in the wall with screw of proper size. Each urinal shall be connected to a 40 mm. diameter waste lead pipe unless otherwise specified, which shall discharge into a channel or a floor trap, or as specified.
- 5.2 HALF STALL URINALS:** The urinal stall and its screen shall be of white vitreous china of approved quality and manufacturer. The stall shall be 114 cm. high and 46 cm. wide and 40 cm. deep. the stall shall be provided with 84 cm. x 36 cm. division plates. In case of two or more urinals there shall be further division plates similar to end screens. The range shall have 15 cm. deep tread plates of first-class quality unless otherwise specified.
- 5.3 FLUSHING:** Where not specified the stall shall be provided with white glazed vitreous china automatic flushing cistern of proper capacity with 6 mm. minimum body thickness unless otherwise specified. The cistern shall be complete with fittings and brackets which shall be fixed to the wall. The cistern shall be connected to the stall through standard size C.P. brass flush pipe with spreader arrangement and clamp unless otherwise specified. Where the cistern has not been specified it will be from distribution line through Brass C.P. connector and spreaders.
- 5.4 OUT-LET.** Each of half stall shall be provided with C.P. Brass outlet (dome shape) grating of size 32 mm. for each half stall and then through PVC pipe to urinal channel.
- 6.0 SQUATTING URINALS.**
- 6.1 SQUATTING PLATES.:** The urinal plates shall be of white glazed vitreous chine integral flushing rim of size 600 mm. x 350 mm. as specified. There shall be

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white vitreous channel with stop and outlet pieces in front. The plate and channel shall be of approved quality.

The joint between the urinal plate and the flush pipes shall be made with putty or white lead mixed with chopped hemp.

6.2 OUT-LET: The squatting plate or a range of squatting plates shall be provided with a 65 mm. diameter standard urinal C.I. trap with vent arm having 65 mm. C.P. brass out-let grating or as specified.

6.3 WALLING.; The squatting plate shall have 1.22 M. high wall in front and on either side. These shall be lined as specified.

7.0 CISTERN.

7.1 MATERIAL.: If not specified a high-level cistern is intended to operate with a minimum height of 191 cm. and a low-level cistern within the height of 60 cm. approx. from the floor finish and the underside of the cistern.

The body thickness of an earthenware cistern 1.3 cm. The cistern with internal parts shall be free from manufacturing faults and other defects and operate smoothly and efficiently. The cistern shall be considered mosquito proof only if there is no clearance anywhere which would permit a 1.6 mm. wire to pass through coupling in the permanent position (i.e; flushing or filling) of the cistern. The outlet fitting of each cistern shall be securely connected to the cistern. In the case of outlet shall be from low level 40 mm. dia. (nominal bore). The outlet of flush pipe from the cistern shall be connected to the pan by means of putty or cement and for E.P.W.C. with rubber joint and putty. The flush pipe shall be fixed to wall by using holder bath clamp.

The discharge rate of cistern shall be about 5 liters in 3 seconds when connected to an appropriate flush pipe and there shall be no appreciable change in the full discharge. The cistern shall have discharge capacity of 5, 10, 12.5, 13, liters with tolerance of +/-0.5 liter and 15 liters with tolerance of +/-1 liter.

The cistern for a `Stall' type urinal or a W.C. may depending an situation be of glazed vitreous china, color or white with the best quality fittings including brackets, as specified.

7.3 FOR SQUATTING PLATE URINAL:

Capacity : The capacity of the flushing cistern and the size of the flush pipe for the number of squatting plate urinals in a range will be as follows.

| Number of urinals of range | Capacity of flushing cistern. | Size of flush pipe Main Distribution. | |
|----------------------------|-------------------------------|---------------------------------------|--------|
| 1 | 5 liters | 25 mm | 20 mm. |
| 2 | 10 liters | 25 mm | 20 mm |
| 3 | 15 liters | 32 mm | 20 mm |
| 4 | 15 liters | 32 mm | 20 mm |

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The cistern shall be fixed on R.S. or C.I. cantilever brackets of requisite strength which shall be embedded or fixed to the wall by means of wooden plug and screws.

8.0 WASHING BASINS

8.1 BASIN: The wash basins shall be of white or colored vitreous china as specified and of approved quality, make and pattern. It shall be one-piece construction with an integral combined overflow. The size of the basin shall be as specified.

8.2 FITTINGS: Each wash basin shall be provided with 15 mm C.P. brass pillar taps as specified, 32 mm C.P. waste - chain and rubber plug, unions, joints etc. complete in all respects of approved quality.

8.3 FIXING. The basin shall be supported on a pair of M.S. or C.I. Cantilever or Nylon type brackets of requisite strength embedded or fixed in position by means of wooden cleats and screws. These metal brackets shall be painted to the required shade including a coat of anti-corrosive paint. The plaster on the rear shall be cut to overhang the top edge of the basin.

8.4 WASTE CONNECTION. The waste shall discharge into a floor trap leading to a gully trap, on ground floor and on upper floor it may be connected to waste pipe stack.

Where specified wash basins shall be provided with a 20 mm. G.I. puff pipe terminating with a brass perforated cap screwed on to it on the outside of the walls or connected to anti-siphoned stack. When the waste pipe discharges freely into a channel or floor trap and is of short length without any bends, no puff will be necessary.

9.0 KITCHEN SINKS: Unless otherwise mentioned the kitchen sink with drain boards shall be of stainless steel and of approved quality, make and pattern. It shall be of one-piece construction with an integral combined overflow, the size of the sink & drain board shall be as specified.

9.1 FITTINGS: Each sink shall be provided with 15 mm. brass C.P. long body bib cock, 40/32 mm. waste, chain and rubber plug, unions joint etc. complete in all respect as specified and of approved quality.

9.2 FIXING: The sink shall be supported on a pair of M.S. or C.I. cantilever brackets of requisite strength embedded or fixed in position by means of wooden cleats and screws. The brackets shall be painted to required shade including a coat of anticorrosive paint.

9.3 WASTE CONNECTION: The waste shall discharge into a flow trap leading to a gully trap, on ground floor and on upper floor it may be connected to waste pipe stack with bottle tap/PVC waste pipe.

10.0 TOILET REQUISITES.

10.1 MIRROR: The mirror shall be of approved make glass with beveled edges. The size and shape of the mirror shall be as specified. It shall be mounted on an asbestos sheet and shall be fixed in position by means of 4 C.P. brass screws and washers over rubber washers and wooden plugs firmly embedded in the wall C.P. brass clamps with C.P. screws alternatively with fiber glass frame.

- 10.2 SHELF.** The shelf shall be of glass of approved quality with edge rounded off or of vitreous china (colored or white) of approved make. The size of the shelf shall be as specified. The shelf shall have C.P. brass or aluminum guard rail with rubber washers on positions resting on glass plate and C.P. brass or aluminum brackets which shall be fixed with C.P. brass or aluminum screws to wooden plugs firmly embedded on the wall.
- 10.3 TOWEL RAIL.** The towel rail shall be of C.P. brass or aluminum with two C.P. brass or aluminum brackets. The size of the rail shall be as specified. The bracket shall be fixed by means of C.P. brass or aluminum screws to wooden cleats firmly embedded in the wall.
- 10.4 CHROMIUM PLATED STOP COCK, TAPS, BIB COCKS, SHOWER SET, GUNMETAL PEETS VALVES:** If not mentioned otherwise schedule, cocks and taps are to be of brass standard head chromium plated of approved make and pattern. They must be capable to withstand at least 10.5 Kg/Sqcm pressure applied for 5 minutes without leakage. The valve is to be of peet type gunmetal valves. Other conditions remain same as cocks and taps.
- 10.5 LIQUID SOAP HOLDER:** This shall be glass or P.V.C. or C.P. brass specified. It shall be fixed in position by means of C.P. brass screws to wooden cleats embedded in the wall. The liquid soap holder shall be of approved make.
- 10.6 TOILET PAPER HOLDER.** The paper holder shall be of C.P. brass or vitreous china as specified. The rolled wooden paper holder shall be made of well-seasoned teak wood.

TECHNICAL SPECIFICATION FOR INTERNAL SANITARY INSTALLATIONS AND DRAINAGE WORK

1.0 GENERAL SPECIFICATIONS

All water supply, internal sanitary installation and drainage work will be carried out by skilled and licensed plumbers in proper workmanlike manner complying in all respects with the requirements of the relevant laws. Preparation and obtaining sanction of drainage and water supply plans, necessary punching of G.I. pipes and fittings from statutory body, which will be incorporated in the work, including any charges if payable to the Municipal or to the local bodies in whose jurisdiction the work is to be executed, shall be borne by the contractor. Items of works not covered by the Technical Specification shall be carried out as per best practice according to the direction of the Architect / Consultant / Owner / Employer. Unless otherwise specified in the general cost of all stages of works mentioned in the schedule of quantities shall be deemed included in the rates of the items.

2.0 LAYING AND JOINTING OF H.C.I. PIPES AND FITTINGS EXTERNAL WORKS

H.C.I. pipes and fittings: Cast iron, soil waste and vent pipes and fittings where specification shall conform to the latest B.S. 1729 for these pipes. The pipes shall have spigot and socket ends.

Weight: Standard weight and thickness of pipes are given below and a tolerance upto 10% may however be followed against these standard weights.

| Sl. No. | Nominal dia of pipe | Minimum Thickness | <u>Soil Waste & Vent Pipes I.S. 1729-1964</u> Nominal weight for 1.8 M long pipe exclusive of ears |
|---------|---------------------|-------------------|---|
| 1. | 50 | 5 | 11.41 |
| 2. | 75 | 5 | 16.52 |
| 3. | 100 | 5 | 21.67 |
| 4. | 150 | 5 | 31.92 |

These shall be free from cracks and other flaws. The interior of pipes and fittings shall be clean and smooth and painted inside with an approved anti-corrosive paint.

Laying Any deviation either in plan or elevation less than $11 - \frac{1}{4}$ degree shall be effected by laying the straight pipes round a flat curve of such radius that minimum thickness of lead at the face of the socket shall not be reduced below 6 mm or the opening between spigot and socket increased beyond 12 mm at any joint. A deviation of about $2 - \frac{1}{4}$ degree can be effected at each joint in this way. At the end of each day's work the last pipe laid shall have its open ends securely closed with a wooden plug to prevent entry of water, soil, rats and any other foreign matter into the pipe.

Lead Caulked Joints with Pig Lead This type of lead caulking is generally done in providing joints in gas water and sewer lines wherever it is practicable to use cost lead caulking, but not in case of wet conditions. The approximate depth and weight of pig lead for various diameters of C.I. pipes and special shall be as given below.

LEAD FOR DIFFERENT SIZES OF PIPES

| Nominal Size of Pipe | Lead / Joint (Kg.) | Depth of Lead Joint (mm) |
|----------------------|--------------------|--------------------------|
| 88 | 1.8 | 45 |
| 100 | 2.2 | 45 |

Note – The quantity of lead given in the table are provisional and a variation of 20 percent is permissible.

Just sufficient quantity of spun yarn shall be put so as to give the specified depth of lead.

JOINTING: The spun yarn shall first be inserted and caulked into the socket as described under jointing with pig ead. Lead wool or yarn shall then be introduced in the joint in strings not less than 6 mm thick and the caulking shall be repeated with each turn of lead wool or yarn. The whole of the lead wool or yarn shall be compressed into a dense mass. The joint shall then be finally finished flushes with face of the socket.

TESTING: All H.C.I. pipes and fittings including joints shall be tested by smoke test and left in working order after completion. The Contractor shall have to rectify all defects traced in such tests of his own expenses to the complete satisfaction of the Architect /Consultant / Owner / Employer.

PAINTING: All exposed H.C.I. pipes and fittings shall be painted with the approved colour with two coats of 1" quality synthetic enamel paint over a coat of primer including preparation of surface.

MEASUREMENTS: The net length of pipes as laid or fixed, shall be measured in the running meters correct to a cm. specials shall be excluded and enumerated separately. The portion of the pipe within the collar at the joints shall however, not be included in the length of pipe work.

Excavation, refilling, shorting and timbering in trenches masonry or concrete pillars and thrust blocks, wherever required, shall be measured separately, under relevant items of work.

RATE: The rate shall include the cost of materials and labor involved in all the operations described above.

2.1 **STONEWARE PIPES FOR DRAINAGES**

Salt-glazed Stoneware Pipes / Lead Glazed Stoneware Pipes

Stoneware pipes and Gully Traps shall be of first-class quality, Salt-glazed and free rough texture inside and outside ad straight. All pipes shall have the manufacturer's name marked on it and shall conform to I.S. 651/1971.

Alternatively, Salt-glazed pipes and fittings which conform to the following specifications may be used.

"The pipes and fittings shall be known as Best Commercial Quality and shall be manufactured of similar materials, and I a similar manner by similar process to those used in producing pipes and fittings in conformity with IS: 561/1955. Every pipe and fittings shall have legibly impressed upon it before fixing the pipes and fittings shall be examined and only those which are sound well glazed, free from visible defects which would impair the efficiency of the pipes or fittings, given a sharp clean note when struck with a light hammer and which are straight, shall be deemed to comply with this specifications".

Laying of Stoneware Salt-glazed Pipes / Lead Glazed Stoneware Pipes

Pipes are liable to be damaged in transit and not withstanding tests which may have been made before dispatch, each pipe will be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear, shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner

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and their use in the works prevented and liable to remove from the site as and when ordered.

The pipes shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipes and as short as practicable to admit the socket and allow the joint to be made.

Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried too low, it shall be made up with cement concrete mix 1:4:8 at the contractor's expenses and charges.

If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to smooth surface the pipes shall be laid on concrete cradles to ensure even bearing. Nothing extra shall be paid on this account.

Each pipe shall be individually set for line and level by means of sight rails and boning rods as per standard practice.

JOINTING OF PIPES: Tarred Gasket shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gasket caulked tightly home so as to fill not more than one quarter of the total depth of the socket.

The remainder of the socket shall be filled with stiff mix of sand cement mortar filled; A fillet should be formed round the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe.

The mortar shall be mixed as needed for immediate use and no mortar shall be beaten up and used after it has begun to set.

After the joint has been made any extraneous materials shall be removed from inside of the joint with a suitable scraper. The newly made joints shall be protected until set from the sun, drying winds, rain or dust. The joints shall be exposed and space left all-round the pipes for inspection by the Employer / Engineer. The inside of the sewer must be left absolutely clear in bore and free cement mortar or other obstructions throughout its entire length. The joints shall be cured for at least for 24 days.

TESTING: All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to man hole. All pipes shall be subjected to a test pressure of at least two-meter head of water at the highest point of the section under test.

The pipes shall be plugged preferably with standard drain plugs (with rubber strings) on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

DRAIN LINES SHALL BE TESTED FOR STRAIGHTNESS BY: Inserting a smooth ball of diameter 12 mm less than the bore of the pipe. In the absence of obstruction such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.

Means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstruction or deviation will be apparent.

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All man-holes shall be tested for water tightness by filling them with water and observing and water subsidence of level. The downstream pipe line shall be filled too with water to avoid the difficulty of removing the stopper form the outgo from the man-holes.

MEASUREMENT: For providing, laying and joining of stoneware pipes measurement shall be recorded for the finished length of the pipe line (including joints) i.e. from inside of one manhole to the inside of other manhole in running meters.

Length between gully traps and manholes shall be recorded between the socket of the pipe and inside of the manhole.

No extra payment is admissible for testing as described earlier.

- 2.2 **MANHOLES:** Manholes of different types and sizes shall be constructed in the Drain Line at such places and to such levels and dimensions as shown in the drawings or as directed by Architects / Consultants / Owner / Employer. The size specified shall indicate the inside dimensions of the manholes. The work shall be done strictly as per the drawings and specifications.

The manholes shall be executed true to dimensions and levels shown on the plan or as directed by Architects / Consultants / Owner / Employer. The excavation shall be done as directed.

Bed Concrete: The manholes shall be built on a bed of cement concrete (1:2:6) 1 Cement: 3 Coarse Sand: 6 Jhamma chips 40 mm size. The thickness of the bed shall be 100 mm unless otherwise specified or directed by Architects / Consultants / Owner / Employer.

Brick Work: The brick work shall be with 1st class bricks cement mortar 1:4 (1 cement: 4 coarse sand).

Plastering & Pointing: The walls of the manholes shall be plastered inside with 20 mm thick cement plaster 1:4) (1 cement: 4 coarse sand) finished with neat cement finished.

Where the saturated soil is met with also the external surface of the walls of the man-hole shall be plastered with 12 mm thick cement plaster (1:4) finished smooth up to 30 cm above the highest sub-soil water level with the approval of "Architects / Consultants / Owner / Employer. The plastered area shall be water proofed with addition of approved water proofing compound as per manufacturer's recommendation.

Benching: The channels and benching shall be done in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone ballast 20 mm and rendered with neat cement finish.

R.C. C. Work: R.C.C. work for slabs shall be in cement concrete 1:2:4: (1 cement: 2 coarse sand: 4 stone ballast 20 mm). The thickness of the slab and reinforcement shall be as per standard drawings or as directed.

Foot Rests: All manholes deeper than (1.2 M) shall be provided with M.S. foot rests. Foot rests shall be 20 mm M.S. Square rods or 20 mm dia. M.S. round bars. They shall be embedded in cement concrete blocks 20 x 20 x 10 CMS of 1:3:6 mix.

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Foot rest shall be fixed 30 CMS apart vertically and staggered laterally and shall project 10 CMS beyond the surface of the wall.

Foot rest shall be painted with 3 coats of anticorrosive bitumastic paint the portion embedded in the masonry or cement concrete block being painted with thick cement slurry before fixing.

Manhole Cover and Frames: Manhole Cover and Frames shall conform to I.S. 1726

The covers and frames shall be neatly cast and they shall be free from air and sand from cold shuts. They shall be neatly dressed and carefully trimmed. All castings shall be free from voids, whether due to shrinkage gas inclusion or other cause. Covers shall have raised chequered design on the top of it to provide an adequate non slip grip.

The covers shall be capable of easy opening and closing. It shall be fitted in frame in workman like manner. The cover shall be gas tight and water tight. The covers used in manholes in drainage line shall invariably bear the work "DRAIN" on the top and those used for storm water drains shall bear the word "STORM WATER DRAIN".

These marking shall be done during casting of the covers. The size of covers specified shall be taken as clear internal dimensions of the frame. The approximate weight of the various types of manhole covers and frames shall be as per able given below.

| Description | Weight of Cover | Weight of Frame | Weight of Cover and frame |
|--------------------|-----------------|-----------------|---------------------------|
| Medium duty 500 mm | 58 Kgs | 58 Kgs. | 116 Kgs. |

2 – ½% variation in weight shall be permissible

Covers and frames shall be firmly embedded to correct alignment and levels in R.C.C. slab in plain concrete as the case may be on the top of the masonry.

After completion of the work manhole covers shall be sealed by means of thick grease.

All manhole covers and frames should be painted both two coats of Acid Alkali proof paint both from inside and outside.

2.3 MODE OF MEASUREMENT: Unless otherwise stated, all pipes shall be measured net, length as laid or fixed and measured liner overall fittings, such as bends, junctions, etc. and given in running meters. The length shall be taken along the center line of the pipes and fittings.

Length of fittings viz; taps, valves, traps, etc. which are paid under appropriate item shall not be re-measured under linear measurements as enumerated above.

Soil, waste and vent pipes shall be measured along the center line of the stack including the connecting bends / tees to W.C. Pan, Nahani trap etc. and shall be paid as enumerated above.

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W.C. pan, Lavatory basins, Sinks, drain board, Urinal, Mirrors, Glass Shelf, Toilet paper holder shall be measured by number and shall include all accessories as enumerated in detailed specifications under each item.

Unless otherwise specified, all types of taps, valves, etc. shall be measured by number and paid separately.

Manholes, Inspection Chambers, Gully traps, etc. shall be constructed according to detailed specifications and measured by number and paid separately. The depth of man hole shall mean the vertical distance from the top of the manhole cover to the outgoing invert of the main drain channel.

LIST OF MATERIALS OF APPROVED BRAND AND MANUFACTURE

| No | Item | Approved make |
|----|---------------------------------|--|
| 1 | Plumbing Fittings | Jaquar/Parryware/Cera/Hindware/Johnson |
| 2 | Ci Pipes | Jaiswal/Gini/ equivalent |
| 3 | PVC/CPVC uPVC pipes | Supreme/Astral/Ashirwad/ Oriplast |
| 4 | Motor pumps | Kirloskar/Crompton/KBC, Willow |
| 5 | Foot valve/ Bal Valve | Leader /equivalent |
| 6 | PVC water tank | Sintex, Supreme/ Asirwad |
| 7 | GI Pipe | TATA/JINDAL/Prakash |
| 8 | SWR pipe | Locally available best quality |
| 9 | CAST iron Manhole cover & frame | ISI approved |
| 10 | Mirror | As approved |

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TECHNICAL SPECIFICATIONS
FOR
ELECTRICAL WORKS

PART – A

1. SCOPE OF WORK

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Bank's site representative. The contractor shall furnish all labour, materials and equipment (except those to be supplied by the Bank) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete electrical system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The scope of works briefed hereunder is indicated not exhaustive. However, the brief scope of work under electrical interior for 2nd to 5th floor includes following works.

- a) Provision various DBs (LDB, PDB, UPSDB, and EMLDB), cables from Tap-off Boxes to DBs etc. with Cable tray and Race way, local isolator for master switches.
- b) Providing UPS/Raw points in each Tables, AC points, Power points, and Lights/fans points.
- c) Complete electrical re-wiring of both stair case.
- d) Supply and installation LED light fixtures with Occupancy sensors where required, BLDC ceiling Fans for Pantry, Hub Room, Record room etc.
- e) Provision of new LAN and Telecom wiring and installation of Rack etc. as per SOQ.
- f) After installation of Raising Main, apart from 2nd to 5th floor necessary connection also to be given from Tap-off Box to respective UPS, RAW, AC, Light DBs of Ground, 1st, 6th and Both Basement and to ensure proper functioning of electrical installations.
- g) Dismantling, removal of all cables, BDs etc. of 2nd to 5th Floor. At the same time to it has to be ensure power supply to remaining floors viz. Ground, 1st, 6th and Both Basements and outside area etc.
- h) Over all co-ordination with HVAC vendor and extend all support for smooth execution of work.

1.1 Under Electrical Infra following works has been considered:

- a) Removal of old panels, after disconnection of supply and removal of cable connection. At the same time during the course of execution of work necessary arrangement has to be made by means of temporary panel or other arrangement etc. for continuity of supply (UPS power, Light supply, HVAC supply, raw power etc.) to all the floor of the building for smooth functioning of the building during execution of work.
- b) Replacement of Main Electrical Panel, APFC Panel at Sub-station, replacement of Main HVAC panel, and Centralized HVAC control desk at 2nd Basement centralized AC Plant room, Provision of new utility panel, DG panel, Fire ATS panel.
- c) Provision of UPS and RAW power rising main from Ground to 6th floor.
- d) Provision of new Earthing pits and connection to all panels, DBs and all other metal parts.
- e) Removal of old cables and laying of new MV/LT cables between various new LT panels, VTPN DBs, LDBs, routed through cable tray/ over wall/ in trench etc. as per site condition.
- f) Light/fan wiring of Sub-station, LED lights, fans etc. for sub-station etc. Old cables if any to be retained (all existing loads of remaining floor other than 2nd to 5th floor, which has taken for renovation)

2. ASSOCIATED CIVIL WORKS

All type of civil minor work (chase cutting, core cutting, making holes plastering work) shall be done to install any type of electrical works good to finish in all respect completion of all electrical works with necessary arrangement subject to Bank/architect satisfaction.

2.1 Project Execution and Management

- a) The Contractor shall ensure that senior planning and erection personnel from his organization are assigned exclusively for this project. The Contractor shall appoint one Project Manager holding senior management position in the organization. He shall be assisted on full time basis by a minimum of one electrical engineer & one senior supervisors. The entire staff shall be posted at site on full time basis. Separate ID card to be given by the Contractor to each worker working on site.
- b) The project management shall be through modern technique. The Contractor's office at site shall be fully equipped with fax, computers & plotter and shall prepare proper bar chart and completion schedules to be submitted & ensure timely completion. Erection engineer and supervisors shall be provided with mobile communication system so that they can always be reached.

- c) For quality control & monitoring of workmanship, contractor shall assign at least one full-time engineer who would be exclusively responsible for ensuring strict quality control, adherence to specifications and ensuring top class workmanship for the electrical installation. Contractor shall furnish details of licenses of supervisors/workmen to be employed at site.

2.2 Performance Guarantee

- a) The contractor shall carry out the work in accordance with the Drawings, Specifications, Schedule of Quantities and other documents forming part of the Contract. The contractor shall give **the 24 months replacement warranty for the lighting fixture and 12 months for all electrical components and equipment's.**
- b) The contractor shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result.
- c) The contractor shall guarantee that the Electrical system as installed shall perform to complete satisfaction of the Bank. The guarantee shall be submitted in the Performa given by the BANK.
- d) Complete set of architectural and electrical drawings will be available in the Architect/Consultant's office and reference may be made to same for any details or information. The contractor shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.
- e) At the close of the work and before issue of final certificate of virtual completion, the contractor shall furnish written performance guarantee against defective materials and workmanship for a period of two years from date of testing, commissioning and handing over. The guarantee shall be submitted in Appendix-II. The Contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to Bank the following:
- i) Any defective work or material supplied by the Contractor.
- ii) Any material or equipment damaged or destroyed as a result of defective workmanship by the Contractor.

2.3 Bye-Laws and Regulations

The work shall be carried out to the satisfaction of the Bank's site representative and in accordance with the NBC (2005), Electrical services, Electrical specification, Regulations of the Electric Supply Authority, Indian Electricity Rules and Regulations, latest Indian Standards.

2.4 Fees and Permits

The Contractor shall pay any and all fees and obtain permits required for the installation of this work. On completion of the work, the contractor shall obtain and deliver to the Bank, certificate of final inspection and approval by the local electricity authority (Municipal, State/Central

govt. whichever is applicable). Fees shall be reimbursed by the bank on the submission of the original bills/receipts.

2.5 Drawings

- a) The Electrical Drawings listed under/ which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipment, electrical points & fixtures.
- b) Shop drawings needs to be submitted by the contractor. The contractor shall follow the intent of tender drawings for preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.
- c) Before submission of shop drawing for approval, the contractor shall examine all MEP services drawings works before starting the work and report to the Bank's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate design of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Bank's site.
- d) Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Architect/Consultant/Bank's site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost.
- e) The contractor shall examine all MEP services drawings and check the as-built works before starting the work and report to the Bank's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Bank's site representative without additional cost to the Bank.

2.6 Specifications

The Specifications shall be considered as part of this contract. The Drawings indicate the extent and general arrangement of power distribution, location of lighting fixtures, controlling switches, wiring system, cabling and earthing. These drawings are essentially diagrammatic. The Drawings indicate the point of termination of conduit runs and broadly suggest the routes to be followed. The work shall be installed as indicated on the Drawings. However, any change found essential to coordinate the installation of this work with other trades shall be made without any additional cost to the Bank. The data given herein and on the Drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings are for the guidance of the External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

contractor, exact locations, distances and levels shall be governed by the site conditions and the Architectural & Interior layouts.

2.7 Shop Drawings

- a) All the shop drawings shall be prepared by contractor on computer through AutoCAD System based on Architectural Drawings, site measurements and Interior Designer's Drawings. Within four weeks of the award of the contract, contractor shall furnish, for the approval of the Architect/Consultant, four sets of detailed shop drawings of all equipment and materials including layouts for all conduit layouts, distribution panels, switch boards, cabinets, special pull boxes, cable trays and any other requirement to be fabricated or purchased by the contractor.
- b) Shop drawings needs to be submitted by the contractor. The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed. He shall issue soft copy in pen drive and hard prints of his shop drawings
- c) These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Architect/Consultant/Bank's site representative. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/ works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings.
- d) Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers listed in the tender document.
- e) When the Architect/Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check print, for approval. The contractor shall submit further four sets of shop drawings to the Bank's site representative for the exclusive use by the Bank's site representative and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.
- f) Shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material to allow Architect/Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved program.

- g) Samples of all materials like conduits, accessories, switches, wires, control cables etc shall be submitted to the Bank's site representative prior to procurement. These shall be submitted in two sets for approval and retention by Bank's site representative and shall be kept in their site office for reference and verification till the completion of the Project.
- h) Approval of shop drawings/Material Submittal shall not be considered as a guarantee of measurements or of building dimensions. Where shop drawings/ Material Submittal are approved, said approval does not mean that the shop drawings/Material Submittal supersede the contract requirements or Local codes, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract or local codes.
- i) Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, wiring or any other part of the mechanical, electrical or architectural layouts; all such re-design, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Architect//Consultant/ Bank's site representative.

2.8 Accessibility

The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in wall cavities and suspended ceilings for proper installation of his conduits cables, cable trays, panels etc. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed control damper, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense.

2.9 Materials and Equipment

All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be strictly in conformity with list of approved manufacturers as per tender document.

The Contractor shall be responsible for the safe custody of all materials and shall insure them against theft or damage in handling or storage etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Bank's site representative within 15 days of the award of the contract. All changes and substitutions shall be requested in writing and approvals obtained in writing from the Bank's site representative.

2.10 Manufacturer's Instructions

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, manufacturer's instructions shall be followed in that case.

2.11 Completion Certificate

On completion of the electrical installation a certificate shall be furnished by the Contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local, state/central govt. / municipal / fire authorities concerned.

2.12 Inspection and Testing

- a) No equipment shall be delivered without prior written confirmation from the Bank's site Engineer. In case factory inspection is carried out then all travelling and lodging expenses for two persons one from Bank and one from consultants shall be borne by the Contractor, also all expenses related to testing shall be to Contractor account. Tests on site of completed works shall demonstrate the following:
- b) That the equipment installed complies with specification in all respect and is of the correct rating for the duty and site conditions.
- c) The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Bank and shall provide test certificate signed by an authorized person. Such test shall be conducted on all materials and equipment and tests on completed work as called for by the Bank at contractor's expenses unless otherwise called for.

2.13 Completion Drawing

Upon completion of the work and before issuance of certificate of virtual completion the contractor shall submit to the Bank's site representative four sets of layout drawings in progressive manner for individual systems drawn at approved scale indicating the complete wiring system as installed. Drawings shall be prepared on AUTO-CAD (latest version). Along with the hard copies, the contractor shall submit copies of all drawings on PENDRIVE and two set of all drawings on hard copies shall also be submitted. These drawings must provide:

- a. All equipment layout & all power distribution panel layout.
- b. Single line power distribution diagram including control wiring.
- c. Cable Trays with number and size of cables installed.
- d. Run and size of conduits, inspection, and junction and pull boxes.
- e. Raceways and Junction Boxes.

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- f. Number and size of conductors in each conduit with phase identification.
- g. Location and rating of sockets and switches controlling the lighting and power outlets.
- h. Location and details of distribution boards/panels, mains, switches along with phase balancing details.
- i. A complete wiring diagram as installed and single line diagrams showing all connections in the complete electrical system.
- j. Location of all earthing stations, route and size of all earthing conductors manhole.
- k. Layout and particulars of all and LT cables.
- l. Instruction, maintenance and operation manuals including maintenance schedule for all equipment. Testing & commissioning reports of all electrical equipment.

2.14 Operating Instruction & Maintenance Manual

Upon completion and commissioning of part Electrical system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Bank's site representative and two for Banks Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

2.15 On Site Training

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labour and helpers for operating the entire installation for a period of Seven (7) working days of four (4) hours each, to enable the Bank's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Bank's personnel in the operation, adjustment and maintenance of all equipment installed.

2.16 Maintenance during Defects Liability Period

- a) The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.
- b) All equipment that requires repairing shall be immediately serviced and repaired. Since the period of maintenance runs concurrently with the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Bank.

2.17 Method of Measurement

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

2.18 Demonstration to Bank

At completion, devices subject to manual operation shall be operated at least three times in presence of Bank's site representative to demonstrate satisfactory operation.

2.19 Tools and Tackles

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, and tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Bank's site representative.

2.20 Site Conditions

| | |
|---|--|
| Location | Bhubaneswar, Odisha |
| Ambient temperature | Relative humidity |
| Maximum = 45 ⁰ C | Maximum = 98% |
| Minimum = 05 ⁰ C | Minimum = 40% |
| Design = 45 ⁰ C | Design = 98% at 50 ⁰ C |
| Seismic factor Zone III as per IS:1893 | Rainfall 1000 mm/year |
| Environmental Tropical/ humid/ corrosive conditions | Location of Equipment Indoor |
| Wind speed | 80 kmph maximum |

Notes: All equipment shall give required output under the conditions of SBI LHO Bhubaneswar.

PART – B

1. TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS

1.1 Internal Wiring:

The system of wiring shall consist of PVC insulated copper stranded conductor flexible wires in metallic / non-metallic (Rigid heavy Duty ISI - marked FRLS PVC Conduits of minimum 2mm Wall thickness and Sizes starting from 20 mm diameter conduits and shall be concealed or surface mounted above false ceiling as called for Prior to laying and fixing of conduits, the contractor shall mark the conduit route, carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the noninterference in the

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route, sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found shall be brought to the notice of the Bank's site representative. Any modifications suggested by the contractor should get written approval before the actual laying of conduits is commenced.

1.2 Conduits and Accessories:

a) Metal Conduits

- i) Conduits and Accessories shall conform to latest edition of Indian Standards IS-9537 part 1 & 2. 16/14 (16 gauge up to 32mm diameter & 14 gauge above 32 mm diameter) gauge screwed GI or MS conduits as specified on schedule of quantities shall be used. Joints between conduits and accessories shall be securely made by standard accessories, as per IS-2667, IS-3837 and IS-5133 to ensure earth continuity. All conduit accessories shall be threaded type only. Only approved make of conduits and accessories shall be used.
- ii) Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

Note: Whatever materials required to be billed by the Contractor should come on site with proper Challan Numbers and quantity mentioned in each such Challan. Shaft which supports sheaves, Gears, coupling and other member which transmit torque shall be provided with tight fitting keys of sufficient strength and quality.

b) Joints

All jointing shall be subject to the approval of the Bank's site representative. The threads and sockets shall be free from grease and oil. End termination of conduit on GI boxes shall be by means of hexagon check nuts & spring washer on both sides of the conduit. The joints in conduits shall be free of burrs to avoid damage to insulation of conductors while pulling them through the conduits. Rubberized bushes shall be used in the conduit entry and exit from DBs, switch boxes etc, so that wires are protected from damage to insulation of the incoming and outgoing wires

c) Flexible Conduits

Flexible conduits shall be made of heavy gauge MS strip galvanized after making the spiral. Both edges of the strip to have interlocking to avoid opening up. Flexible conduit shall be heat resistant, lead coated steel, water leak, fire and rust proof. The flexible conduit shall be heat resistant on continuous temperature up to 150 deg. C and intermittent temperature up to 200 deg. C. The flexible conduit shall be corrosion resistant as per IS-3480 & BS-731. For metallic conduits, bends of defined radius shall be made by compactly filling fine sand inside the conduit length, to avoid non-uniform shape, once the bend is done. Proper jigs shall be used to ensure that the Enamelling /Galvanizing of the Conduit are not damaged.

d) PVC Conduit

- i) Conduits and accessories shall conform to latest edition of IS-9537 part 3. All Vertical conduits in wall shall be Rigid, Medium Strength; all conduits in Slab/Concrete shall be rigid Heavy duty type. Which are unscrewed without coupling and with plain ends. All conduits used shall be ISI-marked and shall not be less than 20 mm diameter. PVC conduit shall be used for all concealed/ embedded installation.
- ii) PVC Conduit Accessories used for conduit shall be of an approved brand and type complying with relevant IS code.
- iii) All accessories used shall be of standard white or black colour, identical to conduit used.
- iv) Plain conduits shall be joined by slip type of couplers with manufacturer's standard sealing cement.
- v) All conduit entries to outlet boxes, trunking and switchgear are to be made with adaptors female thread and screwed male bushes.
- vi) PVC-switch and socket boxes with round knockouts are to be used. The colours of these boxes and the conduits shall be the same.
- vii) Standard PVC circular junction boxes are to be used with conduits for intersection, Tee-junction, angle- junction and terminal. For the drawing-in of cables, standard circular through boxes shall be used.
- viii) Samples of accessories shall be submitted for approval prior to installation.
- ix) All jointing of PVC conduits shall be by means of adhesive jointing. Adequate expansion joints shall be allowed to take up the expansion of PVC conduits.

e) Bends in Conduits

Where necessary, bends or diversions may be achieved by means of bends and/ or circular cast iron boxes with inspection cover and with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly secured and flush with the finished wall surface. No bends shall have radius less than 7.5 cms or three times the outside diameter of the conduits.

f) Fixing Of Conduits

- i) All conduits shall be installed so as to avoid exposure to steam, hot water or any other process pipes. After the conduits, junction boxes, outlet boxes and switch boxes are installed in position, their outlets shall be properly plugged or covered so that water, mortar,

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rodents and insects, insects or any other foreign matter does not enter into the conduit system. Surface conduits shall be fixed by means of heavy gauge GI saddles secured at intervals not more than 1000mm and on either side of couplers or bends or similar fitting saddles shall be fixed at a distance of 300 mm from centre of each fitting. For conduit fixing suitable PVC/Nylon fasteners shall be used.

- ii) Recessed conduiting shall be done by making chase in the masonry by chase cutter; the conduit shall be fixed in the chase by means of GI hooks not more than 600 mm apart. After fixing of conduit the chase shall be filled with cement mortar after fixing of chicken mesh and brought to the original finish level of the surface to the entire satisfaction of Bank.
- iii) Maximum permissible numbers of 1100 volt grade PVC insulated wires that may be drawn into metallic Conduits are given below:

| Size of wires Nominal Cross | Maximum number of wires within conduit size(mm) | | | | |
|------------------------------------|--|-----------|-----------|-----------|-----------|
| Section Area (Sq. mm.) | 20 | 25 | 32 | 40 | 50 |
| 1.5 | 5 | 10 | 14 | -- | -- |
| 2.5 | 5 | 8 | 12 | -- | -- |
| 4 | 3 | 7 | 10 | -- | -- |
| 6 | 2 | 5 | 8 | -- | -- |
| 10 | -- | 3 | 5 | 6 | -- |
| 16 | -- | 2 | 3 | 6 | 6 |
| 25 | -- | -- | 2 | 4 | 6 |

- iv) Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non-metallic or PVC Conduits are given below:

| Size of wires Nominal Cross | Maximum number of wires within conduit size(mm) | | | | |
|------------------------------------|--|-----------|-----------|-----------|-----------|
| Section Area (Sq. mm.) | 20 | 25 | 32 | 40 | 50 |
| 1.5 | 7 | 12 | 16 | -- | -- |
| 2.5 | 5 | 10 | 14 | -- | -- |
| 4 | 4 | 8 | 12 | -- | -- |

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| | | | | | |
|----|----|----|---|----|----|
| 6 | 3 | 6 | 8 | -- | -- |
| 10 | -- | 4 | 5 | 6 | -- |
| 16 | -- | 3 | 3 | 6 | 6 |
| 25 | -- | -- | 2 | 4 | 6 |

1.3 Switch Outlets and Junction Boxes

All outlet boxes for switches, sockets and other receptacles shall be rust proof and shall be as per original equipment manufacturer, having smooth external and internal surfaces to true finish. All outlet boxes for receiving plug sockets and switches shall be fabricated to approve sizes. All boxes shall have adequate number of knock out holes of required diameter and earthing terminal screws. Outlet boxes shall generally be of 50mm depth subject to maximum depth of 65 mm.

1.4 Inspection Boxes

Suitable Size of inspection boxes and pull boxes shall have smooth external and internal finish to facilitate removal and replacement of wires, where required.

1.5 Fish Wire

To facilitate subsequent drawing of wires in the conduit, GI fish wires of 2.0 mm (14 SWG) shall be provided along with the laying of recessed conduit.

1.6 Conductors

All PVC insulated copper conductor flexible , as specified in BOQ, wires shall conform in all respects to Standards as listed under sub-head Indian Standards and shall be IS approved and ISI marked.

1.7 Bunching Of Wires

Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not run in the same conduit. All wires shall have ferrules for identification. Lighting and power circuits shall be separate. Each Power/ Light Circuits neutral shall be individual per Circuit and shall not be looped from any other Circuit.

1.8 Drawing of Conductors

- a) The drawing and jointing of PVC insulated copper conductor wires shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends. Wire reel stands to be used for pulling of wires to avoid kinks. Care shall be exercised while drawing the wires from reels, by taking appropriate measures to ensure that wires are not spread on ground, causing dust and dirt accumulation on the new wires.

- b) Only licensed wiremen (Before doing the work or before appointing him on site contractor has to submit his wiring license to Bank) and cable jointers shall be employed to do jointing work. Before entrusting cable jointing work to any technician, or before appointing Cable Jointers or Wiremen on Site, Contractor has to submit such Technicians / Wireman's / Cable Jointer's license to Bank.
- c) All wires and cables shall be embossed with the manufacturer's label with ISI mark and shall be brought to site in original packing. For all internal wiring. PVC insulated wires of 1100 volts grade shall be used.
- d) The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors. No wire shall be drawn into any conduit until all defective work of conduit installation of any nature that may cause injury to wire is completed. Care shall be taken while pulling out the wires so that no damage occurs to conduits/wire itself, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction. The minimum size of PVC insulated copper conductor wires for all sub-circuit wiring for light points shall be minimum 1.5 sq.mm copper. Separate neutral to be pulled for each circuit.

1.9 Joints

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

1.10 Load Balancing

Balancing of circuits in three phase installation shall be as planned by the Consultants in the tender drawings and shall be checked by the contractor before the commencement of wiring and shall be strictly adhered to.

1.11 Colour Code of The Conductor

Colour code shall be maintained as indicated by the contractor for the entire wiring installations. Red, yellow, blue shall be for three phases, black for neutral and green with yellow band shall be for earthing.

1.12 Switches, Receptacles (Modular), Lighting Fixtures & Control Equipment, Ceiling Fans/Exhaust Fans

a) Switches

All switches shall be enclosed type flush mounted, suitable for 240 volts AC. All switches shall be fixed inside the switch boxes or in mounted over work stations on adjustable flat M S strips/plates with tapped holes and brass machine screws, leaving ample space at the back and sides for accommodating wires or flush mounted with front plate as required. Switch controlling the light point shall be connected to the phase wire of the circuit and load on each switch shall be restricted to maximum 800 watts & maximum 2000 watts per circuit. All wiring accessories shall be BIS ap-

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proved. Perfect alignment shall be maintained while fixing of the back boxes. Unless mention otherwise.

b) Sockets

Socket outlets shall be of the 6A or 6/16A three/Six pin shutter type. The switch controlling the socket outlet shall be on the phase wire of the circuit .An earth wire shall be provided along with the circuit wires and shall be connected to earthing screw inside the box. All sockets shall be shuttered type. Unless mention otherwise.

- i) Every socket outlet shall be controlled by an individual switch unless mentioned otherwise.
- ii) The switch controlling the socket outlet shall be on the `Live" side of the line.
- iii) Socket outlet shall normally be fixed at any convenient height above the floor level as desired by the Architect. The switch for socket outlet shall be kept along with the socket outlet. However, in special case, if desired by the Architect the socket outlet can be placed at the normal switch level. 16 amps socket outlet in the kitchen of shall be fixed at any convenient height above working platform or as specified in drawings.

Generally, switches and outlets shall be planned at a minimum distance of 1 Metre away from any water supply outlet, so that splashed water may not affect the live installation.

- iv) Where socket outlets are placed at lower level, they shall be enclosed in a suitable metallic box with the system of wiring adopted or shutter type sockets shall be provided as specified.
- v) In an earthed system of supply, a socket outlet and plug shall be of three pin type, the third terminal shall be connected to earth.
- vi) Conductors connecting electrical appliance with socket outlet shall be flexible twin cord with an earthing cord which shall be secured by connecting between the earth terminal of plug and the metallic body of the electrical appliance.

c) TV Sockets

TV connector, male Ø 9.52 mm conform to IEC 169-2 - FM connector, female Ø 9.52 mm conform to IEC 169-2 - Frequency bands TV 5-68 120-862 MHz FM 87.5-108 MHz Characteristic impedance 75 Ø Return voice on TV connector Shielding attenuation UHF > 65 dB VHF > 75 dB Max. Incoming cable Ø on input 7 mm.

d) Lighting Features and Associates

1) Scope of Work

Scope of work under this section shall include, supplying, receiving at site, Unloading at site, safe storage, and transportation from point of storage to point of erection, erection and commissioning of light fittings,

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fixtures and accessories including all necessary supports, brackets, down rods and painting etc as required. The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Bank's/Architect.

2) Codes and Standards

The following standards and rules shall be applicable:

| | |
|---|---|
| IS 3646 (1960) | Code of practice for interior illuminator. |
| IS 1913(1969) | General and Safety requirements for electric lighting fittings. |
| Indian Electricity Act and Rules issued here under. | |

3) General Requirement of Lighting Fixtures

- i) All fixtures shall be complete with accessories and fixings necessary for installation whether so detailed under fixture description or not fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box of fixture opening. Fixture shall be installed at mounting heights as detailed on the drawings or instructed on site by the BANK's representative.
- ii) Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening other than shown on the drawings or herein specified shall be submitted to the BANK's representative for approval.
- iii) Fixture shall be completely wired and constructed to comply with the regulations and standards for Electric Lighting Fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and the factory inspection label unless otherwise approved.
- iv) Wiring within the fixture and for connection to the branch circuit wiring shall be not less than 1.5 sq.mm. Copper for 250 Volt application.
- v) All the fixtures are as per the IP - 54 insulation class.
- vi) Vendor shall be responsible for measuring the level of illumination after installation.
- vii) Lighting fixtures shall be designed for minimum glare and for continuous operation under specified atmospheric condition.
- viii) All LED lighting fixtures shall have make in India movement and all kind of TDS related to the lighting fixture shall be furnished for approval.

4) PIR Sensor

- i) The PIR Occupancy Sensor shall detect passive infrared energy for control of any number of independent electrical loads. The light level shall be adjustable from the front of the unit and shall be used to disable the Occupancy Sensor. Timer settings shall be adjustable from 1 second to 18 hours, in one-second increments. The setting range brightness from 10 – 500 Lux, capacity having resistive load up to 1500 watts, switch on delay presence from 10 secs to 10 mins, room surveillance, presence switch off delay 10 secs – 120 min, IP40.
- ii) The Supply Voltage to each PIR Sensor shall be 36VDC @ 18mA. No additional 240V supply shall be required for the unit to operate. The unit shall have suitable operating temperatures between 0-50 Degree C. The unit shall be suitable for wall or ceiling mounting, up to mounting heights of 3m. The Indoor unit shall have a field of view of 90 degrees. The outdoor unit shall have a field of view of 110 degrees.
- iii) The Indoor unit shall have an effective detection area of 6m x 6m. The outdoor unit shall have an effective detection area of 18m radius x 110 degrees.

5) Ceiling Fans (BLDC Type)

| Sl. No. | Parameter | Specification |
|---------|------------------------|---|
| 1 | BLDC Ceiling fan sweep | 1200 + 25mm |
| 2 | No. of blades | 03 |
| 3 | Input Voltage | 230 V AC + 40V Single phase |
| 4 | Frequency | 50 + 2 Hz |
| 5 | THD | Less than 20% |
| 7 | Power consumption | Maximum 35 Watt |
| 8 | BEE Rating | BEE- 5 Star rating, certificate to be submitted along with bid |
| 9 | Power factor | Minimum 0.95 |
| 10 | Material of the blade | Aluminium with matt finish |
| 11 | Warranty: | Minimum 1 year on-site warranty from the date of acceptance. Individual warranty card for each fan to be provided. |
| 12 | Mounting type | Down rod mount (Length 300 + 20mm) |
| 13 | Air delivery (mm) | Should be ISI or BIS certified & confirming to IS: 374:2019 or latest amendment in IS standard. |
| 14 | Colour | Golden Oakwood/Earth Brown/as per bank |
| 15 | Finish | Metallic/Wooden |
| 16 | Insulation | Class E or above |
| 17 | Other requirements | a) Smart remote with Boost, Sleep and Timer mode. b) Fans should provide LED indication for speed c) Mounting accessories such as nut, bolt, clamp etc. |

should also be supplied along with the fan.

d) Type test reports approved from NABL or any other government led / any authorized lab should also be submitted at the time of bid & supply. sample fans, satisfying all the technical parameters and requirement

1.13 MEDIUM VOLTAGE 1.1 KV GRADE XLPE CABLES AND OTHERS

1) General

The MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, Specifications, relevant Standard Specifications and cable manufacturer's instruction. No Cable joints shall be made off proper length shall be taken before cutting the cables and necessary extra length to be provided in termination are for future use.

2) Material

The MV cables shall be cross linked polyethylene (XLPE) insulated PVC inner sheathed and FRLS PVC outer sheath of 1100 volts grade as asked for in the schedule of quantities. All Cables above up to and including 6mm² shall be with copper conductor and above 6mm² shall be aluminium conductor.

3) Technical Requirement

All XLPE Power cables shall be 1100 Volts grade, multi core constructed as per IS: 7098 Part-I of 1988 as follows:

- i) Stranded Copper conductor in case of 10 sq.mm. And above whereas solid conductor in case of 10 sq.mm. And below.
- ii) Armouring should be provided over the inner sheath to guard against mechanical damage. Armouring should be Galvanised steel wires or galvanised steel strips. (In single core cables used in A.C. system armouring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.
- iii) The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS: 5831-1984 extruded to form the outer sheath.
- iv) Conductor shall be of electrolytic Copper/Aluminium conforming to IS: 8130 and are compact circular or compact shaped.
- v) Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.
- vi) In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage.

- vii) Armouring shall be of galvanized steel wire/flat. Repaired cables shall not be used. Current ratings of the cables shall be as per IS: 3961.
- viii) The XLPE insulated FRLS cables shall conform to latest revision of IS and shall be read along with this specifications. The Conductor shall be stranded Copper circular/ sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black colouring of insulation.
- ix) The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.
- x) Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.
- xi) Cables shall be supplied in non-returnable wooden drums as per IS: 10418.
- xii) Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.

4) Inspection

All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

5) Cable End Termination

Cable end termination shall be done in cable terminal box using crimping sockets and proper size of glands of double compression type with shrouding.

5.1. Bonding of Cables

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armour clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on to the cable conductors.

5.2. Cable Installation

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks.

5.3. Laying of Cables on Cable Trays

The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturers. All cables shall be laid with minimum one diameter gap and shall be clamped at every meter to the cable tray. Cables shall be tagged for identification with Aluminum

tag and clamped properly at every 20M. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination. All cables passing through walls shall run through GI Pipes sleeves of adequate diameter 50 mm apart maintaining the relative position over the entire length.

5.4. Laying of Cables in Ground

The width of trench for laying single cable shall be minimum 350 mm. Where more than one cable is to be laid in horizontal formation, the width of the trench shall be worked out by providing 60 mm gap between the cables, except where otherwise specified. There shall be clearance of 60 mm between the end cable and the side wall of the trench. The minimum depth of the cable trench shall not be less than 750 mm for single layer of cables. When the cables are laid in more than one tier the depth of the trench shall be increased by 450 mm for each additional tier.

5.5. Testing Of Cables

i) Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site by the project team.

- a) Insulation Resistance Test.
- b) Continuity resistance test.
- c) Sheathing continuity test.
- d) Earth test.(in armoured cables)
- e) Hi Pot Test.

ii) Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Bank's site representative.

- a) Insulation Resistance Test(Sectional and overall)
- b) Continuity resistance test.
- c) Sheathing continuity test.
- d) Earth test.

iii) All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Bank's site representative, results will be noted and signed by all present and record be maintained.

5.6 TV Cable Co-Axial

The Co-axial cable shall be of wide band type with operation capability upto 500 MHz The ageing resistance of the co-axial cable shall comply with DIN 47252, Part 2, i.e. max. 5% increase in attenuation at 200 MHz measured by artificial ageing (14 days at 80 deg. C) Cables shall meet or exceed the following specifications

1. Conductor:

Conductor Type - Copper Clad Steel (CCS)
Nominal Conductor Diameter - 18 AWG (1.02 mm nominal)

2. Dielectric:

Dielectric type - Gas Expanded Foam PE

3. Shielding:

1st Shield - Aluminium tape bonded to dielectric
2nd Shield - Aluminium braid wire
Flooding Jelly - As per customer requirement (Amorphous PP)

4. Jacketing:

Outer Sheath material - PVC- Black
Nominal thickness - 0.70 mm
Approximate Cable OD - 6.60 mm

5.7 HDMI Cable

- i) High Speed HDMI Cable with Ethernet provides an uncompressed, all-digital interface for both audio and video signals. Our cables infuse high-quality copper wire to resist interference for improved image clarity. We offer HDMI cable at lengths of 1 to 20 meters with resolutions up to True 4K (4096 x 2160 @60Hz).
- ii) **Superior video quality:** True 4K (4096 x 2160 @60Hz): 2L-7D01H, 2L-7D02H, 2L-7D02H-1, 2L-7D03H - 4K (4096 x 2160 / 3840 x 2160 @30 Hz): 2L-7D05H, 2L-7D10H, 2L-7D15H, 2L-7D20H • HDMI Ethernet.
- iii) **Channel functionality:** additional dedicated data channel supports networking* • HDMI (3D, Deep Colour, 4K); HDCP 2.2 compliant • Gold-plated connectors for reliable transmissions • Available in lengths from 1 to 20 m • RoHS compliant Channel enabled, Swings 100 times between angles of +/- 90 degrees, at a frequency of 13 times per minute.

1.14 Cable Tray

1) GENERAL REQUIREMENT

- a) Ladder and perforated type Cable Trays shall be of hot dip Galvanized type and factory fabricated out of CRCA sheet with standard accessories like tee, bends, couplers etc. It shall be the responsibility of the Contractor to ensure that he carries out the erection of the cable trays as per the specification and cable tray layout drawings/procedure released by the SPM for construction.
- b) Cable tray installation involves handling of cable tray components at site, welding of cable tray supports with EPs provided on the civil structure and installation of cable trays as per the details covered in

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the technical specification and building and area wise cable tray layout construction drawings.

- c) Cable tray support channels shall be welded to ceiling / floor supported ISMC box type section which in turn welded to EPs provided on the ceiling / floor. The welding of support channels with box type supports shall be carried out using E 7018 electrode. The details of welding shall be designed and get it approved from the SPM. For wall supported cable trays the support shall be welded to the EPs provided on the wall. Wherever the EPs are found missing embedded plates as per approved procedures/drawings shall be fabricated, painted with two coats of red oxide and fixed with anchor-fasteners of appropriate size.
- d) Support cross arm shall be fixed to the support channel using cotter pins and the cotter pins shall be spitted after installation and the cable tray shall be supported on the support cross arms and shall be bolted/welded.
- e) Two cable tray sections/ tray sections and accessories shall be connected on either side by using connecting pieces with necessary GI hardware's.
- f) Cable trays installation shall be complete with all necessary support channels, support cross arms, connecting piece, cotter pins, elbows, tees, risers and reducers and other accessories as detailed in the cable tray layout construction drawings.

Note: Suitable length of 10 mm dia GI rod suspenders at 1800 mm interval shall be included in the item for perforated type cable tray.

2) Specification for Hot Dip Galvanizing Process

a) Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

b) Coating Requirement

- i) Minimum weight of zinc coating for mild steel flats with thickness up to 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.
- ii) The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

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- iii) The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs; rust stains bulky white deposits, blisters.
- iv) Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing.

1.15 RISING MAINS

1) Scope

The specification covers design, manufacturing, supply, installation, testing and commissioning of Sandwich type busbar trunking for use as feeder busbars for interconnection between separate electrical equipment and load centres, and for use as plug in busbar risers.

2) System Details

The busbar shall be suitable for operation in a 600/1000V system, with frequency of 50 Hz having 100% neutral and internal earth.

3) Standards:

The busbar shall be designed and manufactured in accordance with the following international standards for busbar trunking:

- a) BS 5486 Part 2 : Particular requirements of bus bar trunking systems
- b) IEC 60439 –2 : Particular requirements of bus bar trunking systems
- c) IEC 60529 : Degree of protection

The bus duct shall conform to IEE/NEMA/BUI/JIS for seismic protection certification.

4) Testing

- i) The bus bars shall be type tested at a reputed international test laboratory (ASTA or CPRI) for short circuit withstand. The test shall be for a minimum duration of 1 second. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer.
- ii) Degree of ingress protection (IP rating) shall also be tested at any reputed independent laboratory. This test shall be for IP54 for indoor application and IP65 for outdoor application for sandwiched bus bars.

5) Manufacturer

The manufacturer must have an established track record in design and manufacture of sandwich and cast resin bus-bar trunking, and must have supplied bus bar systems for at least 5-10 years.

The manufacturer must have ISO 9001 certification for design, manufacture and testing of bus bar systems.

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6) Design & Construction Requirement

- i) The bus bars shall be of sandwich construction, non-ventilated design. It shall be possible to mount the bus bar system in any orientation, without affecting the current rating. The bus duct shall consist of three phases and neutral bus bar permanently positioned dust and vermin proof and the degree of enclosure protection shall be IP 55 for indoor installation. The bus bars shall of high conductivity Copper, or Aluminium, as specified in the tender. The maximum hotspot temperature rise at any point in the bus duct at continuous rated load shall not exceed 35°C above a maximum ambient temperature of as per Bhubaneswar, Odisha conditions in any position.
- ii) Where an earth conductor is required, it shall be a separate, integral earth conductor, of the same high conductivity material as the phase conductors.

7) Insulation

The busbars shall be insulated throughout their length by epoxy coating / Mylar. The insulation material used shall be of minimum Class F (155°C). The insulation must comply to UL 94 V-O. It shall be Halogen Free.

8) HOUSING:

The housing shall be made of extruded Aluminium case duly enamelled/ electro-galvanized sheet steel, with an epoxy powder coated paint finish. The housing shall be profiled, to provide higher strength and efficient heat dissipation. The width of the housing shall preferably be the same for all ratings of busbars, in order to provide interchangeability of tap off boxes.

9) JOINTS:

The joints between sections shall be made so as to provide flexibility during installation and expansion/ contraction of bus-bar during operation. The joints shall be of the single bolt type .The joint construction must have the following features.

- a) Heat expansion of at least 3mm per joint.
- b) The joint insulation must be of one piece moulded design and not have any cut edges which can absorb moisture.
- c) The joint construction must allow a +/- 14mm adjustment at the time of installation, for ease of adjusting to site measurement variations.
- d) The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of moulded one piece.
- e) The joint system must be designed in a way that the installer cannot insert the bus duct length too far and damage the bolt insulator.

- f) The bus bar ends shall not have holes or slots at the joints – the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.
- g) It shall be possible to install and remove the joints without disturbing the bus bar run.

10) TAP-OFF UNITS

Where specified, tap off locations shall be provided for insertion of plug in tap off units. The tap off locations shall be covered by hinged plates.

Tap off unit's safety features:

- i) When the door cover is open, it should not be possible to turn the MCCB/ on. This should be by means of mechanical safety locking system and not by the rotary handle of the MCCB.
- ii) The door shall be provided with a lock and keys.
- iii) When the lever is in „on“ position, even with the key unlocked, the operator should not be able to remove the box or open the tap off location cover.
- iv) During insertion, the earth conductor shall make contact first before the phase conductors. This should follow the sequence of first in last out concept.
- v) The tap off unit handle shall be flexible in the sense that the „on/off“ handle can be attached to the left or right side of the box or in front, depending on the site situation.
- vi) When the box is open the live conductors shall be safe guarded by a transparent insulator plate which allows for visible inspection but does not allow touching of the live conductors.
- vii) In the event of a MCCB requiring maintenance or changing, the mechanical interlocking must allow easy access by removing only the front plate and not interrupting the adjacent linkages.
- viii) The tap off boxes will be suitable for accommodating MCCB or other accessories, as required. The tap off units should allow the flexibility of accommodating different, reputed MCCB makes, to be mutually agreed depending on the tender requirements.
- ix) Accessories a full range of accessories like bends, end flanges, end feed units, and support brackets etc. shall be available

11) Installation

Bus ducts running along the wall shall be supported at intervals not exceeding 1.5 m. In case of branching, there shall be support on all branches at a distance of 300 mm from the point of branching, Support shall not be less than 40 x 40 x 6 mm MS angle secured in an approved manner. Supports may also be provided in the form of brackets fixed to walls where the duct runs along the wall. In case of ceiling suspended bus ducts, supports made out of 40x40x6 mm MS angle iron shall be provided. The horizontal distance between two such supports shall not be more than 1200 mm. The ducts supports shall be suspended from suitable approved suspension devices provided in the ceiling. Fire barrier shall be provided at each floor/wall crossing as per relevant IS code

12) Test at Site

The following tests shall be carried out at site and test results to be recorded:

- a) Insulation resistance shall be tested with 1000 V megger and shall be not less than 100 Mega Ohms.
- b) Earth continuity test.

1.16 Floor Raceway

Minimum 2 mm thick metal, factory fabricated, with internal partition of the following sizes including providing removable double folded cover of 1.6mm thick up to 150mm wide raceway and 2mm thick above 150mm wide raceway, knock out holes and fixing accessories earthing stud for terminating 8 SWG copper earth wire complete as required including floor supports, bends, access boxes, tap off boxes and cross over as per site requirement. (Overhead / wall mounted recovery & function boxes shall be 1.6 mm thick). The pre galvanised sheet shall be as per IS 277 or BS 2989 having tensile strength of minimum 500 N/sq.m. and minimum Zinc coating of 275 GSM. Trunking and fittings shall comply with BS 2989 or Indian Standard of IS277 with a GI coating thickness of 275GSM. The minimum size shall be 50mm by 38mm with single compartment. The maximum recommended size for the trunking is up to 300mm by 38mm with triple compartments.

TECHNICAL SPECIFICATIONS FOR INDOOR LT DISTRIBUTION PANEL BOARDS

General Requirement

- a) LT Distribution Panel Board 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 switchgears shall be fully rated at an ambient of 40 Degree C.
- b) The scope of supply covers design, supply, installation, testing and commissioning of L V PCC Panel. Panel shall be fabricated/ manufactured by CPRI approved/ authorized/ certified fabricator/ manufacturer only. The contractor has to take prior

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approval from the Bank after the completion of design part. The contractor shall provide CPRI tested certification for the LT panel board without fail.

c) The equipment covered under this specification shall conform to the latest revisions of relevant Indian and International Standards some of which are listed below:

| | | | |
|----------|------|---|--|
| IS 13947 | 1993 | : | General requirements of Switchgear and Control Gear for Voltage not Exceeding 1000 / 1200V AC |
| IS 11353 | 1985 | : | Guide for uniform system of marking Identification of Bus-bar and Terminals. |
| IS 13703 | 1993 | : | Low voltage fuses |
| IS 2705 | 1992 | : | Current transformers |
| IS 694 | 1990 | : | PVC insulated cables for voltages including 1100 V with Copper and Aluminium conductor) |
| IS 1248 | 1983 | : | Direct Acting Electrical Indicating Analog |
| IS 8623 | 1993 | : | Low voltage Switch gear & control gear assemblies |
| IS 5082 | : | : | Electrolytic Aluminium Bus-bar, Trunking system, Rod tubes & sections for Electrical purposes. |
| IS 13779 | 1999 | : | AC Electric Meters / Static Meters. |

1.1 Construction Features

- a) The panel board shall be metal clad sheet steel enclosed cubicle, fully compartmentalized, floor mounting type suitable for indoor installations and extensible type.
- b) The panel board shall be metal clad sheet steel enclosed cubicle, fully compartmentalized, floor mounting type suitable for indoor installations. All the doors and covers shall be fully gasket to prevent any ingress of dust. The enclosure shall be for Indoor type and completely dust, damp and vermin proof. Gasket used for all doors shall be of double lip type.
- c) The switchboard cubicles shall have structural steel frame work enclosed on all sides and top by CRCA sheet steel of minimum thickness.
- d) The panel board shall have integral base frame.
- e) Removable undrilled gland plates shall be fitted for bottom cable entry.
- f) All fixing bolts, screws etc. appearing on the panel shall be so arranged as to present a neat appearance.
- g) Door hinges shall be concealed type.
- h) Front access shall be available to all components in each cubicle which require adjustment, maintenance or replacement.

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- i) Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders.
- j) Overall height of the panel shall not exceed 2.4 meters. Operating levers, handle etc. of highest unit shall not be higher than 1.7 meters.
- k) Distribution panels shall be of adequate size as indicated in layouts with a provision of spare switchgear as indicated on the Single Line Diagram. Feeders shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top/Bottom to make holes for additional cable entry at site if required.
- l) Every cabinet shall be provided with Trifoliate or engraved metal name plates. Panel board shall be provided with single line circuit diagram showing the arrangement of circuit inside the distribution board shall be pasted inside of the panel door and covered with transparent laminated plastic 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.

1.2 Bus Bar & insulating materials

- a) The bus bars connections and bus taps to individual feeders shall be by means of electrolyte copper bus bar. Bus bars shall be colour coded for ready identification of phases. The Bus bar sizes shall be determined taking into consideration the continuous rating and fault level of 50 KA (1 sec) without exceeding the final temperature of 105 degree C under rated current.
- b) Auxiliary bus bars each of minimum 25 sq. mm thick electrolytic tough pitch copper shall be provided for following applications. Exact number of busbars shall depend on various controls, metering and auxiliary power distribution requirements.
- c) All the Phases and Neutral Bus bar shall be provided in the same compartment for main power as well as for DG power.
- d) The bus bars shall be supported at regular intervals using SMC or DMC insulators. It should have Very high Comparative Tracking Index (CTI > 600 as per IS 2824). Only zinc passivated high tensile strength steel bolts, nuts & washers etc. shall be used for all bus-bar joints & supports.
- e) The bus bars shall be colour coded using identifying colour rings at regular interval. Red, Yellow & Blue colour shall be used for phases & Black for neutral. The earth Busbar shall be identified with Green colour rings at regular intervals. Minimum clearance between phases / live parts shall be 25 mm and phases / live parts / neutral to ground shall be 19 mm except on the equipment terminals.

- f) Spare contacts shall be wired up to terminal block. Auxiliary contacts in the „trip“ circuit shall close before the breaker main contacts close and shall open after the main contacts have opened. All other contacts shall operate simultaneously with the main contacts.

1.3 Small Wiring

All small wiring for Controls, Indication etc. shall be of FRLS (Flame retardant Low Smoke) copper conductor cables. Minimum size of conductor for power circuits shall be 2.5 sq. mm copper or 6 sq. mm Aluminium. All control wiring except CT secondary wiring shall be carried out with minimum 1.5 sq. mm copper conductor. CT secondary wiring shall be carried out with 2.5 sq. mm copper conductor. All wiring shall be securely fixed and neatly arranged to enable easy tracing of wires. All terminal blocks and wires shall be tagged/ Ferruled at both the ends for identification in accordance with IS 11353. All wiring for external connections shall be brought out to the individual terminals on a readily accessible Terminal block; all terminal block shall be shrouded or provided with transparent covers. Clamp type control terminal blocks shall be provided for outgoing control cables. Minimum 10% spare terminals shall be provided for future use. **Control terminal block shall be separated from power terminal blocks by means of an insulating barrier**

1.4 Earthing

- a) Two earth terminals shall be provided on each side of switchboard. An earth bar size must be at least 50 x 10 mm Aluminium suitable for 30kA for 1 sec. shall be provided. The earth bar shall be electrically continuous and shall run the full extent of each board. This earth bar shall be on the same side as the cable entry. Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts not intended to be alive and earth terminals of the unit. Suitable holes with bolts and nuts shall be provided at each end of earth bar of switchgear for connection to a main Earthing grid. The earth bar shall be accessible in each cable entering compartment either directly or through a branch extension to ground the cable armour and shields. 10 mm Ø holes shall be drilled and hardware for connection provided through the earth bus.
- b) Door earthing shall be provided for all the compartment. The armour shall be properly connected with earthing clamp and the clamp shall be ultimately bonded with the earth bar.

1.5 Cable Terminations and Marshalling Box

- a) Cable entry to switchgear shall be from top/bottom of the switchgear or as specified in the technical particulars. Ample space shall be provided in the cable compartment to accommodate XLPE insulated aluminium conductor cable as specified in the technical particulars.
- b) Removable undrilled gland plate shall be provided for termination of Cables

1.6 Painting and Finishing

All metal works and metal parts of the panel boards shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphatizing, passivating and then sprayed with double coated a high corrosion resistant primer shall be applied before painting. The finishing treatment shall be by application of 2-coat of **RAL 7032**.

1.7 Name Plates & Label

- a) A separate name plate mentioning designation of the feeder/panel board shall be affixed prominently on the front top. Details of designation shall be specified. Labels giving following details shall be affixed on each feeder panel
 - a) Feeder No - As per feeder list
 - b) Equipment tag Number and Description
 - c) Rating (kW/kVA/Amp)
- b) A name plate with the panel's designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.
- c) Inside the feeder compartments, the electrical components, equipment, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.
- d) All components whether mounted inside the switchboard or on the door shall be permanently and clearly labelled with reference number and/or letter of their function. Labels for feeder panel designation shall be fixed on the front side of respective panels shall be engraved name plates preferably of 3 ply (Red-White-Red or Black-White-Black) lamincold sheet. However, black engraved Perspex sheet name plates shall also be acceptable. Engraving shall be done with square groove cutters.

1.8 Testing and Inspection

All routine tests specified in relevant Indian Standards and witnessed by buyer. The following tests shall be carried out by the contractor:

- i) Vendor shall submit all following test report as per the latest IS & IEC Standards:
- ii) Short Circuit withstand test for main Busbar and neutral Busbar
- iii) Temperature rise test
- iv) IP test
- v) Operation of all meters.
- vi) Secondary wiring continuity test with a low voltage (6 volts) tester.
- vii) Insulation test with 1000 volts megger, before and after H. V. test.
- viii) H. V. test at 2.5 kV for 1 mtr.
- ix) Earth continuity test with a low voltage (6 volts) tester.
- x) Simulating control circuits for various operations of feeders
- xi) C. T. Polarity Test.

1.9 Technical Requirements - PCC

a) General Requirements

| | | |
|--------------------------|---|--------------------------|
| Service | : | Indoor |
| Enclosure | : | CRCA sheet steel |
| Min Degree of Protection | : | IP 54 |
| Execution | : | Double front |
| Incomer MCCB/ACB | : | Thermal magnetic |
| Outgoing MCCB/ACB | : | Thermal magnetic |
| Extensibility | : | Extensible on both sides |

b) Enclosure

| | | |
|----------------------------|---|--|
| Sheet steel thickness (mm) | : | Base frame/channel – 2.5 mm Front door & Load bearing member – 2 mm Internal partitions – 1.6 mm |
| Surface treatment | : | 7 Tank surface treatment. |
| Painting | : | Epoxy painted. |
| Paint shade | : | Light Grey |

c) Main Busbar

| | | |
|---|---|-------------------------|
| Material | : | Electrical grade Copper |
| Rated continuous current | : | As per design |
| Maximum operating Rated short time current (kA- RMS) | : | 21 kA sym for 1 |
| Heat shrinkable sleeving | : | Yes with Shrouds for |
| Joints Current rating of busbar droppers in vertical section | : | As per requirement |
| Busbar support | : | SMC/DMC |

d) Earth Bus

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| | | |
|-----------------------------|---|------------------------------|
| Material (min.) | : | Aluminium 50 x 10 Sq.mm size |
| Short circuit capacity (KA) | : | 36kA current for 1 Sec. |

1.10 Moulded Case Circuit Breaker (MCCB)

- i) The MCCB should be current limiting type with trip time of less than 10 ms 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 IS13947 – Part 2/IEC 60947-1&2 and should have test certificates for Breaking capacities from independent test authorities CPRI/ ERDA or any accredited international lab.
- ii) The MCCB shall be rated at operational voltage of 415V, 50/60Hz supply system, and 40°C ambient temperature. In case of deration due to operating temperature the same should be indicated and should be done in line with the required ratings of MCCB
- iii) MCCBs shall be available in fixed or plug-in/withdraw able versions as well as in 3-pole and 4-pole versions. For plug-in/withdraw able versions, a safety trip shall provide advanced opening to prevent connection and disconnection of a closed circuit breaker.
- iv) MCCBs shall be designed for both vertical and horizontal mounting, without any adverse effect on electrical performance. It shall be possible to supply power either from the upstream or downstream side.
- v) 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
- vi) Beyond 300Amps capacity MCCBs shall have positive isolation and preferably double break / contact repulsion & double insulation features.
- vii) The breaking capacity of MCCB/ACB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCB/ACBs 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.

1.10.1 Current Limiting & Coordination

The MCCB/ACB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB/ ACB.

1.10.2 Protection Functions:

- a) MCCBs with ratings up to and including 630 A shall be equipped with thermal magnetic trip units in order to ensure the protection against overload and short-circuit.

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- b) Electronic and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings
- c) MCCB/ACBs, the current ratings of which are identical with the ratings of their trip units, shall ensure discrimination for any fault current up to at least 50 kA rms
- d) Protection settings shall apply to all circuit breaker poles.
- e) Thermal-magnetic trip units (up to and including 630 A) shall have adjustable thermal protection from 0.8 to 1.0 times the current rating, Adjustable magnetic protection for current setting values from 10 to 15 times of rated current. It shall be possible to ensure neutral protection. The tripping threshold shall be equal to that of the phases or to a reduced value (generally half of that of the phases). Thermal magnetic MCCB/ACBs shall be provided with identification facility for short circuit fault.
- f) In the event of repeated overloads, the electronic trip unit shall optimize protection of cables and downstream devices by memorizing temperature variations.
- g) Thermal-magnetic trip units shall be adjustable and it shall be possible to fit leadseals to prevent unauthorized access to the settings
- h) Protection settings shall apply to all poles of circuit breaker.

1.11 Additional Details for Individual Accessories

a) Internal Accessories

Functions: 3 different types of auxiliaries shall be available:

- 1) Auxiliary Switch
- 2) Signalling Switch
- 3) Lading contact
- i) Shunt Trip - continuous rated, with wide band site selectable voltage (24-48V AC/DC or 110V DC or 230-500V AC or 230V DC)
- ii) Under voltage Release- continuous rated, with wide band site selectable voltage (24-48V AC/DC or 110V DC or 230-500V AC or 230V DC)
- iii) Mounting electrical auxiliaries should not affect the performance of the breaker.
- iv) Each auxiliary shall be provided with a proper packaging and instruction notice.

b) Mounting and IP

- i) The electrical auxiliaries shall be field installable.

- ii) Electrical auxiliaries shall be easily and rapidly snapped inside the breaker without any tool, behind the auxiliary cover.
- iii) Lead-wires shall not affect the mounting of the breakers side by side.
- iv) When auxiliary cover is opened:
 - 1) Auxiliaries are held in place by themselves,
 - 2) When auxiliaries are mounted, protection against electric shock must be IP20 or IP30.

c) External accessories

- 1. Mounting accessory on the breaker shall not affect its performances.
- 2. Accessories shall be field installable.
- 3. Each accessory shall be provided with a proper packaging and instruction notice.

d) Phase barriers

Phase barriers shall be mounted without any tool and hold in place firmly. They mounted between phases of a breaker and between breakers mounted side by side. The phase barriers shall be made of an isolating material and should be flexible.

e) Terminal shields

Terminal shields shall be mounted without any tool and hold in place firmly. They shall be made of an isolating material. There shall no requirement of special tool to replace the terminal covers.

f) Direct rotary handle

1) Standard:

The rotary handle mounted on the breaker shall meet the IEC60947-2 requirements and will not affect the performance of the breaker. The rotary handle shall meet IEC60447. When the breaker is mounted with a rotary handle, the isolation function remains and fulfils IEC60947-2.

2) Installation:

The direct rotary handle shall be mounted easily and rapidly on the breaker on site without removing any part of the breaker or external accessories. The rotary handle shall be mounted easily on 2, 3 and 4 pole breakers.

3) Operation:

The rotary handle shall indicate the position of the breaker: OFF, TRIPPED or ON. Door should have a door defeat facility to open when the circuit breaker is ON in case of emergency. The door cannot be open if the breaker is ON.

g) Extended rotary handle

1) Standard:

The rotary handle mounted on the breaker shall meet the IEC60947-2 requirements and will not affect the performance of the breaker. The rotary handle shall meet IEC60447. When the breaker is mounted with a rotary handle, the isolation function remains and fulfills IEC60947-2.

2) Installation:

The mounting of the rotary handle should be done without removing the breaker if mounted on its back plate. The rotary handle shall be mounted easily on 3 and 4 pole breakers. The rotary handle shall have pad locking facility in OFF position to take care of the lock outs. The rotary handle shall also provide door defeat facility to open the door for emergency requirement in ON position.

3) Operation:

The rotary handle shall indicate the position of the breaker: OFF, TRIPPED or ON.

h) Plug-in mounting Standard

When the breaker is mounted on a plug-in, the system remains and fulfills IEC60947-2.

Installation

- i) The device shall include the complete accessories for assembling the circuit breaker in plug-in design. Interlocking connecting rod shall be provided ensuring automatic switching off the circuit breaker for handling, inserting & removal.
- ii) The plug in device and circuit breaker shall be provided with a keying set, which prevents inserting any other circuit breaker into the plug-in device.
- iii) The plug-in device shall be provided with position signalling switch

i) Mechanical interlocking

The mechanical interlocking facility shall have following options front mounting mechanical interlocking and parallel switching

j) Testing

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

2. Multifunction Meters (For Incomer MCCB/ACB Feeders)

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- a) The meters shall conform to IEC 61557-12, IEC 62053-22, and IEC 62053-23 standards General Requirements
- b) The meter shall be suitable for operation in single - or multi- phase networks, balanced as well as unbalanced load
- c) It shall be possible to use the multifunction meter directly in 440V networks
- d) The current inputs shall be configurable at site for measuring on x/1 A or x/5 A current transformers
- e) The multifunction meters shall be suitable for operation up to 55 Deg C
- f) The meters shall be suitable for operation with AC auxiliary power and shall have wide tolerance band of 95V to 240 V ($\pm 10\%$)
- g) The multifunction meters shall have high degree of protection (IP65 from the front) against ingress of dust & water
- h) The multifunction meters shall have backlit LCD display with adjustable contrast
- i) The meter shall be tamper-proof (password protected) to avoid mishandling by unauthorized person
- j) The entire multifunction meter should be IP based and can be hooked up to existing Intranet.
- k) All meters should be with accuracy class 0.2 at least.
- l) Meters must have an Ethernet port onboard for communication over Modbus TCP/IP protocol.
- m) All Gateways or converters shall be avoided for sending the data to SCADA Server.
- n) All basic electrical parameters (Current, Voltage, Power, Frequency, Power factor) should be available on display as well for communication with EMS software.
- o) All Meters should have inbuilt and / or expandable Digital input, output for reading the breaker status (Trip / ON / OFF) on inputs and remote ON/OFF of breakers.
- p) Power Monitoring Device must have Battery back up to save data in inbuilt memory (i.e. Daily Energy Counters and Event log reports) which can be retrievable in excel Format

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- q) Digital inputs shall be self-wet or by external 24V DC / AC safety extra low voltage power supply.
- r) Digital outputs shall be able to drive contactor or a relay contact. Also outputs shall be usable with limit or Boolean logic of multiple limits overflow or underflow and limit function shall be parametrical for value, parameter, underflow or overflow and hysteresis.
- s) All meters shall have possibility of remote parameterization & monitoring using the software apart from front fascia programming using soft keys
- t) All metered values will be in "true RMS" values. The monitor shall include a keypad allowing for the viewing of different selected values. The monitor shall display the following values:

| | |
|---|--|
| Voltages | Phase-phase / phase-neutral |
| Currents | Per phase |
| Apparent, active and reactive power | Per phase and total |
| Power factor | Per phase and total |
| Frequency | 48...52 Hz |
| THD for voltage and current | Per phase |
| Min. / max. values | Voltage - phase-phase, phase-neutral, Current / Power / Power factor / THD per phase, Frequency, Three phase average voltage and current |
| Average values | Voltage - phase-phase, phase-neutral Voltage min. / max. : for phase-phase, phase-neutral Current: Current min. / max. |
| Active energy | Import / export; high / low tariff |
| Reactive energy | Positive / negative; high / low tariff |
| Apparent energy | High / low tariff |
| Energy demand per measuring period | Three phase average rating for active and reactive power: 1 to 60 min. |
| Min. / max. rating values within the measuring period | Should be possible to be measured |
| Meter running counter | Uptime in hours |

| | |
|-------------------|--|
| Universal counter | Pulse counting of external devices like water, gas, etc. |
|-------------------|--|

3. Multifunction Meters (for Outgoing MCCB/ACB Feeders)

The meters shall conform in all respects to International standards – IEC 61557-12, IEC 62053-22, IEC 62053-23 or the relevant Indian standards with latest amendments thereof.

General Requirements:

- i) The meter shall be suitable for operation in 3 - phase networks, balanced as well as unbalanced load.
- ii) It shall be possible to use the multifunction meter directly in 440V networks.
- iii) The current inputs shall be configurable at site for measuring x/5 A current transformers.
- iv) The multifunction meters shall be suitable for operation up to 55 Deg C
- v) The meters shall be suitable for operation with AC auxiliary power and shall have wide toleranceband of 100V to 240 V ($\pm 10\%$)
- vi) The multifunction meters shall have high degree of protection (IP65 from the front) against ingress of dust & water
- vii) The multifunction meters shall have backlit LCD display with adjustable contrast
- viii) The meter shall be tamper-proof (password protected) to avoid mishandling by unauthorized person
- ix) All metered values will be in "true RMS" values. The monitor shall include a keypad allowing for the viewing of different selected values. The monitor shall display the following values

| | |
|-------------------------------------|--|
| Voltages | Phase-phase / phase-neutral |
| Currents | Per phase / neutral |
| Apparent, active and reactive power | Per phase and total |
| Power factor | Total |
| Frequency | 48...52 Hz |
| Min. / max. values | Voltage - phase-phase, phase-neutral/ Current/ Neutral current/ Power/ Power factor/ Frequency |

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| | |
|---|--|
| Active energy | Import/ export/ net |
| Reactive energy | Import/ export/ net |
| Energy demand per measuring period | Three phase average rating for active and reactive power: 1 to 60 min. |
| Min. / max. rating values within the measuring period | Should be possible to be measured |

a) Measurement Accuracy

i) The multifunction meters shall be of high accuracy type and shall have the following levels of accuracy. (Accuracy class in accordance with IEC 61557-12:2007-08)

1. Voltage Class 1
2. Current Class 1
3. Power Class 1
4. Power factor Class 2
5. Active energy Class 1 in accordance with IEC 62053-22:2003-01
6. Reactive energy Class 3 in accordance with IEC 62053-23:2003-01

ii) The meter shall have at least 2 Digital Input and 2 Digital Output as standard

b) Communication

The meters shall have inbuilt RS485 MODBUS RTU. It shall be possible to parameterize the device either by the keys on the device or through parameterization software.

4. Analogue Meters

- a) All voltmeters and ammeters shall be flush mounted of size minimum 96 mm conforming to class 1.5 of IS:1248 for accuracy.
- b) All voltmeters and indicating lamps shall be through MCB"s.
- c) Meters and indicating instruments shall be flush type.
- d) All CT"s connection for meters shall be through Test Terminal Block (TTB).
- e) CT ratio and burdens shall be as specified on the Single line diagram.

5. Current Transformers

- i) Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary's for operation of associated metering – [630 / 5 amp, 8 VA].
- ii) 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 4.5 and measurement CTs shall be of accuracy class I.

6. Potential Free Contacts

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

7. Indicating Panel

- a) 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.
- b) On all the incomers of panels, ON/OFF indicating LED lamps shall be provided and shall be suitable for operation on AC supply. Phase indicating LED lamps shall be associated with necessary ON/OFF toggle switch

8. Miniature Circuit Breaker (MCB)

- i) 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.
- ii) The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

9. Power Contactors:

- i) Contactors shall comply with IS/IEC 60947-4 or EN 60947-4-1
- ii) Contactors for motor application shall be of 3 Pole AC3 duty as specified in standards.
- iii) Main contacts of contactors shall be silver plated copper. Spare contact kits & spare coils replacement shall be possible for the entire range, for maintenance purpose.
- iv) For ratings higher than 80A, coil replacement shall be possible without disturbing busbar/ cable termination.
- v) Contactors shall be electro-magnetically controlled, double air-break type. Contactors shall be four-pole, triple-pole, double-pole or single-pole as shown on the Drawings.
- vi) The contactors shall be capable of frequent switching and shall operate without derating at 55°C for AC3 applications.
- vii) The rated voltage of the contactor and the rated insulation voltage shall be 415V and 690V respectively.
- viii) The rated impulse voltage of the contactor shall be at least 8 KV.

10. Air Circuit Breakers (ACB)

- a) The ACB shall conform to the requirements of IEC 60947-2 / IS 13947-2 ,VDE 0660 Part 101, IEC 68 Part 2-30 (climate –proof) .The circuit breaker shall be suitable for 415 V + 10%, 50 Hz supply system and ambient temperature of 50 Deg C without any deration. 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.
- b) 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.
- c) All ACB shall be suitable for reverse fed without compromising on the performance.
- d) 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 and shall be integral part of ACB. Inspection of main contacts should be possible without using any tools.

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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. The control panel of ACB along with its operating device shall project through cutout in the door. The door cutout shall be provided with suitable gasket for IP40 protection.

- e) All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts.
- f) All electrical closing breaker shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB. Electrical operating mechanisms shall be suitable for remote operation
- g) 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 2 NO and 2 NC auxiliary contacts shall be provided on each breaker for external purpose. It shall be possible to add 2 more NO and 2 NC contacts later.
- h) The ACB shall have trip free mechanism which prevents the operating mechanism from interfering with the tripping or opening action. Castell key lock if asked for shall be provided on the ACB itself. It should be possible to remove Castell key only when breaker is in OFF condition. All the vital accessories like Shunt, Motor, and Under Voltage coils shall be accessible from the front and should not need removing of the breaker from its panel for the replacement.

10.1 Painting

All metal works and metal parts of the panel boards shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphatizing, passivating and then sprayed with double coated a high corrosion resistant primer shall be applied before painting. The finishing treatment shall be by application of 2-coat of grey colour paint confirm to RAL code 7302.

10.2 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.

10.3 Protection

- a) The ACB shall be equipped with an integral self-powered microprocessor based current release, which works on true R.M.S values for ensuring accurate protection. The microprocessor based release should have integral LCD display of phase and neutral currents and also the maximum loaded phase. The display should be visible with a minimum 20% loading of the phase currents. Henceforth in this document the release shall be referred to as the Over current release.

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- b) The protection unit should meet the EMI/EMC requirement as per latest standard.
- c) Integral Test facility to test healthiness of release and the trip circuitry shall be provided on the Over current release.
- d) The breaker shall offer complete over current protection to the electrical system in the following four zones:
 - i) Long-time protection.
 - ii) Short time protection with intentional delay.
 - iii) Instantaneous protection.
 - iv) Ground fault protection.

The ACB control unit shall offer the following protection functions as standard:

- i) Long-time (LT) protection with an adjustable current setting and time delay;
- ii) Short-time (ST) protection with an adjustable pick-up and time delay;
- iii) Instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
- iv) Current and time delay setting shall be indicated in amperes and seconds respectively on a digital display.
- v) Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

AUTOMATIC POWER FACTOR CORRECTION (APFC) PANEL BOARD

1.0 GENERAL REQUIREMENT

- i) This specification covers the general requirement of Design, Manufacture, Supply and Installation and Commissioning of Automatic Power Factor Correction equipment intended to be used with low voltage distribution networks.
- ii) Power Correction equipment shall be able to improve the power factors as per regulations and shall be suitably rated to improve the system power factor such that power factor shall be near 1 i.e. Unity, based on the actual load.
- iii) **Panel shall be fabricated/ manufactured by CPRI approved/ authorized/ certified fabricator/ manufacturer only confirming to International standards (IS) & in accordance to the Rules and regulations of IEC. The contractor has to take prior approval from the Bank after the completion of design part. The contractor shall provide CPRI tested certification for the LT panel board without fail.**
- iv) The power factor correction equipment shall normally be connected to the main LV Distribution Boards through dedicated feeders.
- v) This equipment's installed shall be stand alone with LV Distribution Board.
- vi) Power Factor Correction Equipment's would improve the power factor as per the local utility regulation. This equipment's shall be routine tested (CPRI approved testing) at Panel manufacturer's before dispatch

1.1 APPLICABLE STANDARDS

Unless specified otherwise the capacitor banks shall conform in design, material, construction and performance to the latest editions of the IEC standards, their corresponding British European / (BS EN) standards and in particular to the following publications :

- IEC 61921: Power capacitors – Low voltage power factor correction banks.
- IEC 60831-1 & 2: Shunt power capacitors of the self-healing type for A.C. systems having a rated voltage up to and including 1000 V.
- IEC 60076-6: Power transformers - Part 6: Reactors
- IEC 60085-1: Electrical insulation – Thermal evaluation and designation.
- IEC 60664: Insulation coordination for equipment within low-voltage systems.
- IEC 61439-1: Low-Voltage Switchgear and Control gear Assemblies Part 1: General Rules
- IEC 60947-1: Low-voltage Switchgear and Control gear - Part 1: General Rules
- IEC 60947-2: Low voltage Switchgear and Control gear - Part 2: Circuit Breakers.
- IEC 60947-4-1: Low-voltage Switchgear and Control gear – Part 4-1: Contactors and Motor-starters.

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In addition to the above listed standards, the Rules and Regulations for electrical installations issued by CEA regulation shall also be adhered to.

1.2 MARKING

The contractor shall arrange the following minimum information provided by the CPRI approved panel manufacturer/ fabricator in an instruction sheet and on a rating plate to be fixed on the assembly:

- i) Manufacturer's name or trademark.
- ii) Serial number.
- iii) Date of manufacture
- iv) Rated reactive power, QN in kilovars (kVAR).
- v) Rated voltage, UN in volts (V).
- vi) Rated frequency, fN in hertz (Hz).
- vii) Minimum and maximum ambient temperatures in degrees Celsius (°C).
- viii) Degree of protection.
- ix) Short-circuit withstand strength, in amperes (A)
- x) Number of stages
- xi) Step Size

1.3 CONSTRUCTION OF AUTOMATIC CAPACITOR BANK

- a) The enclosure housing the capacitor units shall be of minimum 1.5 mm thick electro galvanized sheet steel folded and welded construction, floor mounted, free standing or wall mounted type with a minimum degree of protection of IP54 complete with a hinged lockable door.
- b) The enclosure system for capacitor bank shall be of certified design as per IEC 62208.
- c) The enclosure system should have a minimum of IK 10 certification (external mechanical impacts) in accordance with IEC 62262.
- d) All enclosures or partitions including locking means and hinges for doors shall be of a mechanical strength sufficient to withstand the stresses to which they may be subjected in normal service, and during short-circuit conditions.
- e) The enclosure will be wired at manufacturer/fabricator and comprise mainly of the following:
- f) Power factor improvement 3 phase capacitors, arranged in a suitable number of stages.
- g) Detuned three phase iron cored series reactors for harmonic current suppression.
- h) Microprocessor based power factor regulator for automatic power factor correction.
- i) Pole contactors for capacitor switching.
- j) MCCB/ACB for each capacitor stage unless stated otherwise.

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- k) Main incomer isolating switch / MCCB/ACB.
- l) The automatic capacitor bank should be ready for field connection with all the components clearly labelled for identification.
- m) To ensure safety, reliability and accountability of component coordination, all the major capacitor bank components such as capacitor units, de-tuning reactors, PF controllers, Contactors called for in this specification should be preferably from a single source (manufacturer/ fabricator).
- n) The Power Correction Equipment shall be installed in cool ventilated locations away from other heat radiating elements.
- o) The Capacitor bank shall be designed for trouble free service under the arduous temperature conditions as defined in Regulations and typical of Indian Continental. The capacitor banks shall be operable on 50 Hz and shall meet or comply with IEC, IEC 61921 and IEC 61439-1.
- p) The Design and component selection shall consider continuous operation at a maximum system voltage of 415V and ensure reliable performance in consideration of room ambient temperature of 50 degree Centigrade.
- q) All Components shall can withstand the dynamic, thermal and dielectric stresses resulting from prospective short circuit currents without damage or injury to personnel. Due to the presence of harmonic currents and to manufacturing tolerances, components (MCCB/ACB/ isolator, busbar & power cables) shall be designed for 1.5 time's nominal current.
- r) Ventilation fan and air inlet filter unit shall be provided for the capacitor banks to facilitate better heat dissipation. The ventilation fan shall be operated by two numbers of thermostat set at 35° and 55° Centigrade respectively.

Dimensional Details: Standard dimensions shall be ensured confirming to the IS and IEC standards mentioned above.

1.4 BUSBARS

The bus bar section of power factor assemblies shall withstand, as a minimum, the fault current of the system at the point where it is intended to be connected. Usually, these assemblies are connected onto a section of the main installation where the fault current are quite high. Busbars shall be tin plated copper, rectangular and rigid construction.

- i) The phase busbar shall be arranged systematically and assembled using insulators.
- ii) The busbars shall be protected with poly carbonate shrouds from all sides.
- iii) The busbar assembly shall be fully shrouded (at least IP20) so that no live parts are accessible. Phase identification (colour code) shall be done systematically.

- iv) The rating of the main busbar assembly shall be to suit the incoming switching device rating. The main busbars of the capacitor banks are preferred and recommended to be in separate busbar chamber, wherever applicable.
- v) Tin plated copper busbar and earth busbar shall be located on both sides of the incomer Busbars shall be provided with a suitable termination facility for connecting the main neutral and earth cable. Extra termination shall be provided on the earth bar for the bonding purpose.

1.5 TECHNICAL REQUIREMENTS

a) CAPACITOR UNITS:

Capacitor units shall be/of/have:

- i) Dry type Suitable for a network voltage of 415 volts and shall be rated at minimum 525V for 14% detuned banks.
- ii) Suitable for continuous operation line current of 1.3 times the current which occurs at rated sinusoidal voltage and rated frequency excluding transients
- iii) Temperature category of the capacitor units shall be -5/D. Casings shall be metallic. Completely leakage proof.
- iv) Self-healing ability, where a damage of some part of the dielectric due to a microscopic flaw in the dielectric film, caused by over-voltage, can be self-healed quickly and returned to normal state.
- v) A 3-phase pressure switch disconnecter for protection against internal faults, over pressure, etc. should be available. The pressure switch disconnecter must isolate all the three phases simultaneously in the event of fault. To ensure full functionality of the pressure switch disconnecter, its elastic elements must not be hindered, i.e.
 - a. Connecting lines must be flexible leads.
 - b. There must be sufficient space for expansion above the connections
- vi) The built-in discharge resistors shall not be accessible (fitted at CPRI approved manufacturer/ fabricator) and tamper proof. The discharge resistors shall ensure reduction in capacitor voltage to less than 50 volts in 1 minute after switch off.
- vii) The total losses including discharge resistors to be less than 0.5 Watt/KVAR. Capacitance tolerance shall be within +/- 5% of the rated value.
- viii) The Capacitor unit shall be capable of withstanding the inrush current up to 200 times of its rated current. The rated output of the capacitor Unit has to be at the supply voltage of 415V and 50 Hz frequency. The capacitors used in conjunction with reactors shall be suitably de-rated to deliver the designed output at 415V.

1.6 DE-TUNING REACTORS:

- i) Capacitors with detuned filtering technique shall be employed to correct power factor while avoiding the risk of resonance condition. This shall be performed by shifting the resonance frequency to lower values where no harmonic currents are present, by introducing a filter reactor in series with the capacitors, such that the capacitor / reactor combination is inductive at the dangerous fre-

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quencies but capacitive at fundamental frequency. The circuit should be tuned such that the series resonant frequency should be below the lowest harmonic order expected to be present in the electrical network.

- ii) The de-tuning reactors shall be connected in series with each capacitor stage and shall be of iron cored type.
- iii) The Detuned Reactor Should be equipped with Thermal Switch inside the Winding which should cut-off the respective contactor in case of Over-temperature.
- iv) The capacitors used in conjunction with reactors shall be suitably de-rated to deliver the designed output at 415V.
- v) The reactor insulation shall be Class "F" or above. The maximum temperature of the reactor at maximum continuous RMS amperage shall be no higher than 145°C at a 50°C ambient. The capacitor and reactors shall be tuned for 135 Hz and 14% relative impedance (2.7 tuning order) for 3rd Harmonics present in the network.
- vi) Tolerance of reactors shall not exceed +/-3% of rated value.

1.7 POWER FACTOR CONTROLLERS:

The power factor controller shall/ be able to:

- a) Microprocessor based and shall be able to sense the reactive current requirement of the network and shall switch ON / OFF the required stages of a capacitor bank.
- b) Insensitive to wirings such as reversed CT connection, PT on a wrong phase etc.
- c) Detect any stage size by automatic recognition and the switching sequences should be user defined. Detect the capacitor bank size if in case the present capacitor is replaced by a new capacitor of different rating is equipped with LCD display which shows at any time power factor, internal capacitor bank temperature and monitors the line frequency. Suitable for 1A or 5 A current input and operating in temperatures up to +50 degrees C.
- d) The capacitor Bank and controller shall ensure that after the loss by fault of any one stage, it shall continue to operate automatically and shall follow rotational switching.
- e) Recognize the connection of CT and Voltage and be able to automatically adjust itself to the phase angle difference. Regulator shall have capability to automatically search and set the C/K setting, it shall be also possible to program the C/K setting manually.

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- f) Have a minimum time delay of 120 seconds for switching on a capacitor into circuit, from its last disconnection from the circuit.
- g) The ingress protection of the regulator shall be minimum IP 40.
- h) The regulator must be panel mounted, shall be easily programmable and shall conform to safety guidelines as per IEC 61010-1:2001
- i) The regulator must be suitable for 1 A or 5 A current input and shall be sensitive to a minimum current input of 40mA. The threshold value for the operating temperature and system harmonics shall be programmable and the regulator shall be able to switch off the connected capacitor stages if the actual values exceed the thresholds.
- j) Be equipped with RS 485 communication port.
- k) Dual Cos Phi – The Controller should have programmable dual cos phi to differentiate the need in compensation (Cos Phi) when the operating condition changes. Like Peak Hour (2:30- 3:30PM when the target PF could be increased to 0.98) or Power factor correction needs with a utility supply changes when the input power is from an in house Generator.
- l) The Power factor controller/regulator should allow the following readings.
- Automatic initialization and stage rating detection
 - Any step sequence detection (User definable step sequence)
 - Measurement of capacitance per stage
 - Cap bank over load current ratio
 - THD Voltage
 - Quadrant operation
 - Active , reactive and apparent power
 - Record of the Max temp internal of the capacitor bank since reset
 - System Voltage (V AC)
 - Frequency
 - Apparent Power (kVA)
 - Apparent current (A)
 - Temperature (°C)
 - Real time Cos phi
 - kVAR value to target Cos phi
- m) The controller shall initiate alarms and warnings in the following events.
- Temperature limit is exceeded
 - Insufficient capacitor output
 - Overload current ratio limit is exceeded
 - Under voltage, Over voltage

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- THDU limit is exceeded
- Low power factor/ under compensation.
- Over compensation
- Over current, Capacitor step defective

1.8 SHORT CIRCUIT AND OVER LOAD PROTECTION:

1. The capacitor bank shall be protected by a suitably rated MCCB/ACB/Isolator at the incomer. It shall have a rotary front operating door mounted handle and should be interlocked with the door to ensure that the capacitor bank is de-energized when door is open.
2. The MCCB/ACB/Isolator shall be a three pole and shall fully comply with the requirements of the IEC 60947-1 & 2. The MCCB/ACB shall be rated for a minimum insulation voltage of 660 V and designed for an ambient temperature of 50 degrees C.
3. The current rating shall be at least 1.5 times the full load current of the capacitor bank and shall have a better mechanical endurance. Each stage of the capacitor bank shall also have a suitably rated MCCB/ACB with an electronic over-current relay for overload protection. The electronic over-current relay shall be adjusted to trip if the RMS current of the stage exceeds the overload setting.
4. The combination of bus bars and stage breakers shall be designed for a short circuit withstand of 50kA/1sec minimum.

1.9 CONTACTORS (STAGE SWITCHING):

Depending on the requirements either electromagnetic contactors or electronically controlled (using durable and reliable electronic switch) contactor shall be used for switching PFC capacitors. For transient free switching, suitable and durable electrical/ electronic switches viz. capacity duty contactors shall be employed.

ELECTROMAGNETIC CONTACTOR:

- a) The contactors shall be of type three poles, specially designed for switching capacitors and shall be able to make against large transient current peaks at a high frequency of several kHz that can occur on capacitor switching.
- b) The contactors shall isolate all the three supply phases to the capacitor on switch off. Contactors along with damping resistors (AC6b) shall be used where there is a possibility of high inrush peak current to reduce it.

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- c) The capacitor contactors shall be weld resistant up to a possible peak in-rush current of $200 * IR$.
- d) In case capacitor banks are supplied with Harmonic Blocking Reactors, contactors for capacitor switching shall be without damping resistors (AC3), because the peak current limitation is provided by Reactor impedance.

1.10 ENCLOSURE SYSTEM:

- a) The enclosure system for capacitor bank shall be confirming to above mentioned IS and IEC and to be manufactured/ fabricated by the CPRI approved manufacturer/ fabricator.
- b) The degree of protection of enclosures system shall be in accordance with IEC 60529.
- c) The enclosure system should have a certification for steady-state sinusoidal vibration in accordance with standard IEC 60068-2-6. Components such as capacitor units, series reactors, power factor controller, electro-magnetic / thyristor switched contactors, switch-disconnector, MCCB/ACBs etc. shall be housed in this enclosure. The capacitor bank shall be free-standing type and the doors must incorporate 3- point locking system.
- d) The enclosure door shall be interlocked with the incomer MCCB/ ACB/ switch-disconnector. Doors shall not be provided on the sides / rear of the capacitor bank.

1.11 TESTING AND INSPECTION

ROUTINE TESTS:

- i) All tests shall be carried out in the presence of engineer in charge, at such times as he may reasonably require.
- ii) All samples used for testing shall be to the contractor's expense and shall not affect the quantities to be supplied under this contract.
- iii) All instrument used for testing purposes, shall be calibrated by an approved/ competent authority.
- iv) The cost of all tests shall be included in the contract price and shall not be quoted separately.

A) Routine Tests on Capacitor Bank

- a. Routine tests shall be carried out on every Low voltage power factor correction banks before delivery at site.
- b. Inspection of the assembly including inspection of wiring and, if necessary, an electrical operation test
- c. Dielectric test

- d. Checking of protective measures and of the electrical continuity of the protective circuit
- e. Verification of insulation resistance

B) Routine Tests on Capacitor Units

Routine tests shall be carried out on every capacitor unit before delivery at site. Capacitor Banks should accompany the test reports of the Capacitor Units used issued by the manufacturer/supplier.

- i) Capacitance measurement and output calculation
- ii) Voltage test between terminals
- iii) Voltage test between terminals and container
- iv) Test of the internal discharge device
- v) Sealing test

1.11.1 SITE TESTS:

- i) The contractor is responsible for submitting all contract works to site inspection by the Engineer/Architect, before site tests are commenced. Before commissioning, the contractor shall depute an experienced and qualified testing Engineer from the manufacturer's works to carry out the following tests on the equipment and such other tests that may be considered necessary by the Bank.
- ii) The Site Acceptance Test (SAT) format for the capacitor bank shall be forwarded to the Bank prior to the SAT.
- iii) The contractor's test engineer shall complete all pre-commissioning tests, commission all plant and equipment supplied by him and hand over the entire contract works to the Bank in good shape. All the charges connected with the pre-commissioning tests of the equipment shall be included in the tender price.
- iv) The contractor's testing engineer shall carry out all commissioning tests in co-operation with and to the satisfaction of the Bank's engineer who will take part in all these tests.
- v) The contractor shall arrange all test equipment required for different test purposes at site. The following test / inspections at site shall be carried out:

Mechanical Tests:

- i) Visual inspection to verify degree of protection, creepage and clearance distances.
- ii) All conductors and cables are checked for proper routing and all devices for proper mounting.

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- iii) Check effectiveness of all mechanical devices, e.g. handles, locks, interlocks, operating devices, etc. Check panel conformity to drawing and Engineer's requirements.
- iv) Checking of all mounting plates/fasteners.
- v) Checking of dimensions and components as per drawings.
- vi) Electrical circuits fasteners tightness/ surface area contacts.
- vii) Crimping and ferrules as per drawing.
- viii) Labels / Identification/ Nameplate.
- ix) All doors checking, safety and accessibility.
- x) APFC cabinet surface finish / smoothness.

Electrical Tests:

- i) Insulation resistance test shall be carried out at all main circuits through to final terminals. Insulation resistance shall exceed 10 mega ohms. Record all measurements.
- ii) Function test of all circuit breakers switches, contacts, etc. and every circuit to verify correct operation.
- iii) Insulations resistance tests between phases and earth and between neutral and earth.
- iv) Operational test on components.
- v) Switching ON / Off of capacitor bank on various kVAR requirement.
- vi) Checking of Display parameters.
- vii) Switching On / Off logic verification.
- viii) Data communication through Serial / optical port
- ix) Verification of data/reports/functions in base computer software.

Final Inspection

Prior to energizing the capacitor bank the following checks shall be carried out at site:

- i) Operate the equipment through all design functions, including remote operation, actuation of alarm and indicating devices, mechanical and electrical tripping and closing and operation of the protective devices.
- ii) Insulation resistance measurements on the buses, phase to phase and phase to ground, with all breakers in the fully connected position and contacts open.
- iii) Control circuit insulation resistance to ground.

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- iv) Inspect all relays and protective devices, and verify settings in accordance with the manufacturer's instructions. Inspect current transformers and relays for correct polarity of connections and the installation of jumpers on unused current transformer circuits.
- v) Manually close and trip each breaker checking and adjusting the main contact alignment and wiring action in accordance with the manufacturer's instructions.
- vi) Test protective relay operation for incomer air circuit breakers.
- vii) With the capacitor bank in operation, measurement of the power factor and system harmonics shall be carried out after commissioning of equipment.

1.12 DRAWINGS AND INFORMATION

The contractor shall furnish the following drawings and documents placed inside the drawing pocket of the equipment supplied:

- i) Dimensioned drawing showing outline of the capacitor bank
- ii) Single line diagram showing all the major electrical components.
- iii) Protection and control schematics of the capacitor bank
- iv) Details of cable terminations and fittings.
- v) Technical Manual giving installation, operation and maintenance instructions

1.13 GROUNDING

All the equipment including enclosure shall be connected to a 40mm x 6mm earth copper bus bar.

1.14 HANDLING

- a) The equipment shall be provided with lifting rings, or provided with provision for using a fork lift truck for handling.
- b) For installation, a 250 mm space shall be provided from the front of the bank, in order to have an optimal position of the bank for good ventilation.

1.15 Warranty

The equipment will be guaranteed on our workmanship for a period of 12 months from the date of commissioning.

2.0 GENERAL PARTICULARS AND GUARANTEES

a) CAPACITOR BANKS

- i) Manufacturer & Country of Manufacture.
- ii) Type and reference
- iii) Supply Voltage V
- iv) Highest System voltage V

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- v) Rated Frequency Hz
- vi) Rated Capacity of Complete Bank
- vii) Number and Capacity of each stage.
- viii) Connection configuration
- ix) Method of control
- x) Electrical Clearances
 - a. Phase to phase
 - b. Phase to earth

b) CAPACITOR UNIT

- i) Manufacturer/Country of Manufacture
- ii) Type reference
- iii) Standards Applicable
- iv) Rated Power kvar
- v) Rated Voltage V
- vi) Rated Current A
- vii) Rated Frequency Hz
- viii) Rated Capacitance Mf
- ix) No. of Elements(Capacitors)
 - a. In Series
 - b. In parallel
- x) Continuous Over voltage withstand capability %
- xi) Maximum permissible Overload current %
- xii) Capacitor loss at rated Voltage W
- xiii) Type of active element
- xiv) Built in Discharge device resistance
- xv) Discharging time to achieve 50V
- xvi) Service indoor/outdoor

c) POWER FACTOR CONTROLLER

- i) Manufacturer/Country of Manufacture
- ii) Type
- iii) Rated Current
- iv) Supply Voltage

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- v) Measuring Accuracy
- vi) Regulation steps
- vii) Setting range
- viii) Over compensation monitoring Yes/No
- ix) Manual Mode Yes/No
- x) Degree of Protection
- xi) Communications
- xii) Operating conditions Temp, Humidity

d) DE TUNING REACTORS

- i) Tuning frequency
- ii) Detuning Factor
- iii) Inductance
- iv) Nominal Voltage
- v) Insulation Temperature class

e) ENCLOSURE

- i) Type
- ii) Degree of Protection
- iii) Sheet Thickness
- iv) Painting thickness
- v) Mechanical Protection
- vi) Compartments
- vii) Cooling arrangements and louvers
- viii) Dimensional details

CENTRALIZED HVAC CONTROL DESK

The Centralized Control desk Panel has to be designed and approval to be taken from the Architect before fabrication and consultation with HVAC Vendor. Cubicle type floor mounted power cum control panel board of specified size and following depth made out of Not less than 1.6 mm thick CRCA MS sheet with suitable size compartments for necessary cut-outs for on off lamps and push buttons for remote connection for all AHU DB to the local push button for start and off in a central connection with all ON and OFF indication lamp. Push button details (start Stop):17 Nos. for AHU'S +4 Nos. for cooling tower Chiller pump -5 Nos. On off with selector with for local and remote operations with LED indicator ON & OFF for each chiller Pump, CDS pump - 5 Nos. With ON & OFF push button switch & selector switch for remote and local operation, LED indicator for ON & OFF for each CDS pump

Scope includes

1. Removal of all wires connected from existing Control desk panel
2. Removal of the old control desk

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3. Laying of new control wires by HVAC Vendor Scope However, all support shall be given for smooth execution of work.
4. Installation of new panel after panel design approval from the architect
5. Connection of control wire from Control desk to respective Starter panel located near equipment or main HVAC panel in Co-ordination with HVAC vendor.
6. Final testing shall be carried out along with HVAC vendor.

Three set of control and panel drawing to be submitted after commission

Panel other constructional details as per LT Panel specs.

1.18 DISTRIBUTION BOARD (MCB, RCCB, DB)

Final Distribution Boards (DBs) shall be suitable for operation 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 be manufactured by a manufacturer listed in tender document.

FDB"s shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS/IEC 61439-1/2.

A. CONSTRUCTION FEATURES

- i) DB"s shall be made out of 1.2 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of DB shall be folded and braced as necessary to provide a rigid support for all component. DB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction. The 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 2.5 Sqmm tinned stranded copper connectors.
- ii) 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 confirm to IS- 8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC. DB should have an intermittent plate for ease in maintenance and rework. Earthing links to be mounted on surface of db to get better contact.
- iii) 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 DBs.

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- iv) Knockout holes of appropriate size and number shall be provided in the DB"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.
- v) A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.
- vi) Installations 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.
- vii) The board shall be installed at a suitable 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.
- viii) Degree of protection shall be IP-42 for indoor application, IP-54 for kitchen and IP-55 for outdoor application. 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.
- ix) Phase segregation to be maintained in all three phase distribution boards. Earthing shall be provided in each FDB"s.
- x) 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 gray painting shade no. RAL-7032 of IS Code No.5.
- xi) Testing of panels shall be as per following codes:
 - IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.
 - IS:13947: 1993 Degree of protection.

1.19 AUTOMATIC TRANSFER SWITCH

Supply and installation of automatic transfer switches (ATS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

A. CODES AND STANDARDS

The automatic transfer switches and controls shall conform to the requirements of:

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UL 1008 - Standard for Transfer Switch Equipment OR IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment

B. MECHANICALLY HELD TRANSFER SWITCH

- i) The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid or linear motor mechanism (up to 1000A). Main operators which include over current disconnect devices shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions under normal operation and only one position at a time, normal or emergency.
- ii) The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- iii) All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
- iv) Inspection of all contacts shall be possible from the front of the switch without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- v) Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- vi) Where neutral conductors must be switched as shown on the plans, the ATS shall be provided with fully rated simultaneous switching or overlapping neutral transfer contacts. In case of overlapping neutral, the neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts when provided shall not overlap for a period greater than 100 milliseconds.
- vii) Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

C. MICROPROCESSOR CONTROLLER

- i) The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance.

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- ii) A single controller shall provide different selectable nominal voltages as per local requirements for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. And Frequency sensing each.
- iii) The controller shall be connected to the transfer switch by an inter-connecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
- iv) All customer connections shall be wired to a common terminal block to simplify field-wiring connections. All the programming shall be done through keypad
- v) The controller shall meet or exceed the requirements for Electro-magnetic Compatibility (EMC) as follows:

| | |
|------------------------|--|
| EN 55011:1991 | Emission standard - Group 1, Class A |
| EN 50082-2:1995 | Generic immunity standard, from which: |
| EN 61000-4-2:1995 | Electrostatic discharge (ESD) immunity |
| ENV 50140:1993 | Radiated Electro-Magnetic field immunity |
| EN 61000-4-4:1995 | Electrical fast transient (EFT) immunity |
| EN 61000-4-5:1995 | Surge transient immunity |
| EN 61000-4-6:1996 | Conducted Radio-Frequency field immunity |
| IEEE472 (ANSI C37.90A) | Ring Wave Test. |

D. VOLTAGE AND FREQUENCY SENSING

- i) Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

| <u>Parameter</u> | <u>Sources</u> | <u>Dropout / Trip</u> | <u>Pickup / Reset</u> |
|------------------|----------------------------|-----------------------|-----------------------|
| Undervoltage | 3 ϕ N& 1 ϕ E, | 70 to 98% | 85 to 100% |
| Overvoltage | 3 ϕ N& 1 ϕ E, | 102 to 115% | 2% below trip |

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| | | | |
|----------------|-----|-------------|---------------|
| Underfrequency | N&E | 85 to 98% | 90 to 100% |
| Over frequency | N&E | 102 to 110% | 2% below trip |

- ii) Repetitive accuracy of all settings shall be within minimum $\pm 1\%$ over an operating temperature range of -20°C to 60°C .
- iii) Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
- iv) Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases and frequency.

E. TIME DELAYS

Following adjustable time delays shall be provided:

- i) 0 to 6 seconds to override momentary normal source outages and delay all transfer and engine starting signals.
- ii) 0 to minimum of 120 sec on transfer to emergency for controlled timing of transfer of loads to emergency.
- iii) 0 to 60 minutes for actual normal power failures and for the test mode function. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- iv) 0 to minimum of 30 minutes on shut down of engine generator for cool down.
- v) 0 to minimum of 1 minute to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable time delay.

F. ADDITIONAL FEATURES

- i) A three position momentary-type test switch shall be provided for the test / automatic / reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
- ii) A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- iii) Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the

normal source and one contact closed, when the ATS is connected to the emergency source.

- iv) LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- v) LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

G. WITHSTAND AND CLOSING RATINGS

- i) The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of over current protection shown on the plans.
- ii) The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

H. TESTS AND CERTIFICATION

- i) The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- ii) Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- iii) The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

1.20 DISMANTELLING WORKS

1.0 TERMINOLOGY

Dismantling: The term 'Dismantling' implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the building as specified or shown on the drawings or unless specified.

Demolition: The term 'Demolition' implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings.

1.1 GENERAL

This chapter relates to buildings only.

1.1.1 MEASURE FOR DISMANTELING

1.1.1.1 All materials obtained from dismantling or demolition shall be the property of the bank unless otherwise specified and shall be kept in safe custody until they are handed over to the Bank/ authorized representative.

1.1.1.2 The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the directed. The operations shall be got approved from the Bank before starting the work. Due care shall be taken to maintain the safety measures prescribed in IS 4130.

1.1.1.3 Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions and necessary scaffolding with suitable double scaffolding and proper cloth covering shall also be provided, as directed by the Bank./Architect.

1.1.1.4 Necessary precautions shall be taken to keep noise and dust nuisance to the minimum. All work needs to be done under the direction of Bank./Architect. Helmets, goggle, safety belts etc. should be used whenever required and as directed by the Engineer-in-Charge. The demolition work shall be proceeded with in such a way that it causes the least damage and nuisance to the adjoining building and the public.

1.1.1.5 Dismantling shall be done in a systematic manner. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cutters may be used carefully as directed. The dismantled articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Bank./Architect.

1.1.1.6 Where existing fixing is done by nails, screws, bolts, rivets, etc., dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off.

1.1.1.7 Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer-in-Charge within a lead of 50 metres. All unserviceable materials, rubbish etc. shall be disposed off as directed by the the Bank.

1.1.1.8 The contractor shall maintain/disconnect existing services connection, whether temporary or permanent, where required by the Bank./Architect

1.1.1.9 First-aid equipment shall be got available at all demolition works of any magnitude.

10.1 SAFETY EQUIPMENT

A. DANGER PLATE

Danger plate shall be provided on HV and MV equipment. MV danger notice plate shall be 200 mm x 150 mm made of mild steel at least 2 mm thick with vitreous enameled white on both side and with inscription in red colour on front side.

B. INSULATING MATS FOR ELECTRICAL PURPOSE

Insulating Mats shall be in compliance with IS-15652-2006 /IEC 61111-2002-06. The insulating mats shall be made of Elastomer (a generic term that includes rubber, latex and elastomer compounds that may be natural or synthetic or a mixture of both) for use as floor covering for the protection of workers on AC and DC installation with the system voltage up to 66 KV AC and 240 volts DC.

Classes and max. use voltages of insulation mats shall be as follows

| Sr.No. | Class | AC (rms) | dc (volts) |
|--------|-------|----------|------------|
| i) | A | 3.3 | 240 |
| ii) | B | 11 | ---- |
| iii) | C | 33 | ---- |
| iv) | D | 66 | ---- |

Mats shall be resistant to acid and oil and low temperatures and shall be identified by the respective class symbol.

Thickness of mats for different classes, physical properties, dielectric properties and all other specification shall be as per IS: 15652-2006. be free from blisters, pin holes, cracks, embedded foreign matters and other defects.

1.21 EARTHING WORKS

The system shall be TNS with four wire supply system (R, Y, B, N and 2 Nos. E) brought from the main L T Panel. All the non-current carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All metal work such as pipe lines, ducts, cable trays, stair case railing etc shall be bonded to earth.

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All earthing shall be in conformity with IS: 3043 1987, and the basic system of earthing shall be

TNS.

1.1 Earthing Conductors

Earthing conductors shall be of copper / GI as mentioned in schedule of quantities and shall be protected against mechanical injury and corrosion.

1.2 Sizing and continuity of Earthing Conductors

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits up to 15 amps shall be earthed with PVC insulated copper wire. Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI, wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel. . All exposed ground conductors run shall be taken in a neat manner horizontal, vertical and parallel to the building walls or columns and shall not be laid haphazardly. All connections to the grounding grid shall be made with **earthing** strip welded to grid and bolted at equipment ends.

The following must always be ensured in earthing system.

1. All earths must be interconnected at the earth pits. This includes generator neutrals, transformer neutrals, transformer body, lightning protection system earths, UPS earths etc.
2. Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.

1.3 Earth Resistance

The resistance of earthing system shall not exceed 1 ohm.

1.4 Earth Electrode

1.4.1 Conventional Plate Electrode

- i) **(Alternate-I) Copper Earth Electrode**

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Earthing electrode shall be 600 x 600 x 3.15 mm thick tined copper plate electrode, with 2 Nos 50 x 6 mm copper strips from earth plate electrode to inspection chamber, 50 mm dia medium class GI pipe, CI funnel with 20 gauge GI wire mesh, masonry chamber 1000 x 500 mm with concrete base C I heavy duty / chequered plate manhole cover with frame painted with bitumastic paint and packing with mixture of charcoal and common salt around plate electrode including digging of pit up to permanent moisture level and as per soil condition but not less than 3 meter sand back filling as required.

ii) GI Earth Electrode

Earthing electrode shall be 600 x 600 x 6.3 mm thick GI plate electrode, with 2 nos. 50 X 6 mm GI strips from earth plate electrode to inspection chamber, 50 mm dia medium class GI pipe, CI funnel with 20 gauge GI wire mesh, masonry chamber 1000 X 500 mm with concrete base CI manhole cover with frame painted with bitumastic paint and packing with mixture of charcoal and common salt around plate electrode including digging of pit up to permanent moisture level but not less than 3 meters and back filling as required.

iii) Maintenance free Electrode

In maintenance free earthing copper bonded earthing rod electrode shall be of 14.35 mm in diameter and 3 meter length. The rod shall be placed in a 150 mm dia augured hole in the ground and then surrounded by ground enhancement material in either a dry form or pre mixed in a slurry. Once set, ground enhancement material becomes hard and as such holds positively to the rod as well as surrounding ground.

Earth rod offered shall have passed the test required of BS7430/ ANSI/ UL467 and confirm to the adhesion of the copper coating to the steel core (Design feature that prevents the ingress of moisture and subsequently the integrity of the rod.

Minimum 0.25 mm thickness of copper shall be deposited over the steel core as per BS 7430/ UL

467. Average life of the ground rod shall be 30 years in most soil.

Ground enhancement material shall be as per IEEE-80 clause 14.5d with a resistivity of less than 0.12 ohm-meter. The ground enhancement material shall be permanent and not leach any chemicals in to the ground. The pH value of the ground enhancement material shall be 6.9 to 7.2 of 100 gm/ lit @ 20 Deg.C.

Minimum 30 Kg of ground enhancement material shall provide for each earth electrode.

Inspection chamber shall be of 400 x 500 mm with concrete base CI manhole cover with frame painted with bitumastic paint. 2 Nos. of 50 x 6 mm cross section & 300 mm long copper strip to be clamped with copper clad rod electrode have sufficient nos (But not less than 4 Nos.) of 10 mm dia GI nuts & bolts for connection to the equipment / interconnection to the other pits to form equipotential bonding.

1.5 Earth for UPS / Low Volt / Servers

Clean earth shall be used for earthing UPS / Low volt / Server systems and shall be separate from safety earthing. Separate earthing electrode shall be provided in the ground and from this electrode, single core copper cable of required size shall be taken as earth conductor to be laid in the vertical shaft. This cable shall be terminated on each floor in a earth terminal box located in the shaft. The earth terminal box shall have 50x6mm copper bus bar mounted on insulators. The busbar shall have facility to terminate the incoming earth cable as well as required number of outgoing earth conductors.

GUARANTEE PROFORMA

GUARANTEE FOR ELECTRICAL INSTALLATION

Guarantee the year round Electrical System which we have installed in the Complex described below:

Building : SBI LHO

Building Location :Bhubaneswar,

For a period of **24 months replacement warranty for the lighting fixture and 12 months for all electrical components and equipment's.** from the date of acceptance of the total installation, WE AGREE TO repair or replace to the satisfaction of the Bank, any or all such work that may prove defective in workmanship, equipment or materials within that period, ordinary wear and tear and unusual abuse or neglect excluded, together with any other work, which may be damaged or displaced in so doing. In the event of our failure to comply with the above mentioned conditions within a reasonable time, after being notified in writing, we collectively and separately, do hereby authorize the Bank to proceed to have the defects repaired and made good at our expense, and we shall pay the cost and charges thereof, immediately upon demand.

WE ALSO HEREBY UNDERTAKE to test the entire installation upon completion and ensure that all units are functioning satisfactorily

SIGNATURE OF CONTRACTOR

for ELECTRICAL INSTALLATION

DATE

SEAL

LIST OF INDIAN STANDARDS (IS)

Latest edition of following standards shall be referred

| | |
|------------------------------|---|
| IS : 374 | Ceiling fans and regulators (3rd revision) |
| 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 : 1255 | Code of Practice for installation and maintenance of Power Cables up to and including 33 KV rating (Second Revision) |
| IS : 1258 | Bayonet lamp holders(Third revision) |
| IS : 1293 | Three pin plugs and sockets outlets rated voltage up to and including 250 volts and rated current up to and including 160 amps. |
| IS : 1554 (Part - I) | PVC insulated (Heavy Duty) electric cables for working voltages up to and including 1100 volts. |
| IS : 1646 | Electrical installation fire safety of buildings (general) Code of practice. |
| IS : 1885 | Glossary of items for electrical cables and conductors |
| IS : 1913 | General and safety requirements for fluorescent lamps luminaries Tubular. |
| IS : 2026 (Part I to IV) | Power Transformers/ Dry Type Transformers |
| IS : 2071 | Methods of high voltage testing |
| IS : 2309 | Protection of building and allied structures against lightning |
| IS : 2551- | Danger notice plate. |
| IS : 3043 | Code of practice for earthing. |
| IS : 3427 | AC Metal enclosed switch gear and control gear for rated voltages above 1 KV and up to and including 52 KV. |
| IS : 3480 | Flexible steel conduits for electrical wiring. |
| IS : 3837 | Accessories for rigid steel conduit for electrical wiring. |

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| | |
|-------------------------|---|
| IS : 4146 | Application guide for voltage transformers |
| IS : 4615 | Switch socket outlets. |
| IS : 5133 (Part -I) | Boxes for the enclosure of electrical accessories. |
| IS : 5216 (Part-I) | 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 : 7098 - (Part - II) | Cross linked polyethylene insulated PVC sheathed cables. For working voltages from 3.3 KV up to and including 33 KV |
| IS : 8130 - | Conductors for insulated electric cables and flexible cords |
| IS : 8623 -(Part - I) | Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC and 1200 V D C. |
| IS : 8623 - (Part - II) | Bus Bar trunking system |
| IS : 8828 | Miniature Circuit Breakers |
| IS : 9537 | Rigid Steel Conduits for electrical wiring (Second Revisions) |
| IS : 10810 - | Methods of test for cables. |
| IS : 12640 - | Earth Leakage Circuit Breakers |
| IS : 13947 (Part-II) | Air Circuit Breaker |
| IS : 13947 | Moulded Case Circuit Breakers |
| 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. |
| Other Codes | National Building Code 2005, NEC2011, NLC 2011, IGBC |

ABBREVIATIONS

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

| | |
|--------|--|
| CU | stands for copper. |
| GI | stands for Galvanised 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 V) |
| LV | stands for Low Voltage (32 V & Below) |
| HT | stands for High Tension |
| LT | stands for Low Tension |
| SF6 | stands for Sulphur Hexa Fluoride Gas |
| VCB | stands for Vacuum Circuit Breaker |
| 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 Engineer: |
| 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 |

1.24 APPENDIX-IV

| APPROVED MAKE LIST OF ELECTRICAL MATERIALS | | |
|--|---|---|
| SL. NO | MATERIAL DESCRIPTION | APPROVED MAKES |
| 1 | PVC CONDUIT (FR Grade, ISI Mark) | : PRECISION / AKG/BEC/AVON PLAST/GM/CLIPSAL |
| 2 | STEEL CONDUIT (ISI MARKED) | : BEC/BHARAT/GUPTA/AKG/RMCON/STEEL KRAFTS |
| 3 | PVC FRLS COPPER WIRES (ISI MARK/Telephone Cables/ Co-axial TV Cable | : KEI / POLYCAB / ANCHOR / RR CABLE / HAVELLS/FINOLEX |
| 4 | MODULAR SWITCH / SOCKET /TV SOCKET /DATA SOCKETS/ ELECTRONICS REGULATOR/ AC STARTER SWITCH etc. | : LEGRAND (Myrius) / ABB (IVIE)/ SCHNEIDER (ZENCELO)/WIPRO-NORTHWEST – ARTISA/MK-BLENZE PLUS |
| 5 | MCBs/ ELCB/RCBO/ISOLATOR | : LEGRAND / L & T / ABB /Siemens/Schneider/Hager |
| 6 | MCB DB/ INDUSTRIAL SCOKET OUTLET. | : LEGRAND (Ekinoxe) / L & T (AU) / ABB (Itus)/Siemens- Be-taguard/Schneider- Acti9 |
| 7 | APFC RELAY | : L&T/BELUK/SIEMNS/EPCOS/ABB/SCHNEIDER/NEPTUNE |
| 8 | HV / MV XLPE INSULATED CABLE | : KEI / POLYCAB / RR CABLE / HAVELLS/FINOLEX/NICCO/UNIVERSAL/CCI |
| 9 | HT CABLE TERMINATION KIT | : RAYCHEM / M-SEAL/3M |
| 10 | PVC BATTEN/ANGLE HOLDER | : ARIS-TO/ANTEX/PRAKASH/KINJAL/ANCHOR |
| 11 | GI CABLE TRAYS & RACEWAYS | : NIEDEX / PROFAB / JKR / CLASSIC / SHRUTI / PATNY |
| 12 | EXHAUST FAN/ CEILING FAN | : ALMONARD / HAVELLS / CROMPTON / ORIENT/BAJAJ/ATOMBERG |
| 13 | LED LIGHT FITTINGS | : PHILIPS / HAVELLS / WIPRO/CROMPTON/BAJAJ |
| 14 | ACB | : L & T (OMEGA)/ ABB (FORMULA) / SCHNEIDER (NW) /SIEMENS (3WL) |
| 15 | MCCBs | : L & T (D-Sine) / ABB (Formula) / SCHNEIDER (NSX) /SIEMENS (3VA) /LEGRAND (DPX3) |
| 16 | CONTACTOR AND OVER LOAD RELAY | : L & T / ABB / SCHNEIDER /SIEMENS/C&S |
| 17 | DIGITAL METERS | : CONSERV (SCHNEIDER) / L&T / ABB/ SECURE/MECO/RISHAB/AE |
| 18 | CAPACITOR ALL PP / HEAVY DUTY MPP | : SCHNEIDER / L&T / EP-COS/SIEMENS/MIHIR |
| 19 | CTs & PTs | : KAPPA / KALPA / AE/SCHNIDER/L&T/GILBERT |
| 20 | CONTROL SWITCHES | : KAYCEE/GEC/ALSTOM /L&T-SALZER/SCHNIDER/HPL |

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| | | | |
|----|---|---|---|
| 21 | ELR / EARTH FALUT RELAY | : | ALSTOM / PROK DIVS / ER /SIEMENS/SCHNIDER/ABB |
| 22 | PROTECTVE RELAY | : | ALSTOM / PROK DIVS / ER /SIEMENS/SCHNIDER/ABB |
| 23 | PUSH BUTTONS | : | TECHNIC / ABB /SCHNEIDER / L&T/SCHNIDER |
| 24 | INDICATING LAMPS (LED) | : | TECHNIC / ABB /SCHNEIDER / L&T/SCHNIDER/BCH/EMCO/KAYPEE |
| 25 | LUGS / GLANDS | : | DOWELLS / JAISON/ COMET / BRACO |
| 26 | TERMINALS & CONNERCTORS | : | ELMEX /CONNECTWELL/ESSEN-FINGER TOUCH PROOF OR AS EQUIVALENT. |
| 27 | FERRULES | : | MAYFAIR/Balaji Industries OR AS EQUIVALENT. |
| 28 | RAISING MAIN, BUS BAR TRUNK-ING, ATP-OFF BOXES | : | C&S/ SCHNEIDER /LEGRAND/ABB/L&T |
| 29 | BUS BAR SUPPORTS | : | C&S/ SCHNEIDER /LEGRAND/ABB/L&T |
| 30 | UPS / INVETERS | : | VERTIVE/NUMERIC/BPE/APC/ABB |
| 31 | BATTERY | : | AMRARAJA/EXIDE/AMCO |
| 32 | STABILIZER | : | DUBAS / EMERSON / POWERTRO-NIX/SERVO |
| 33 | Load Monitors / Controller | : | Ducati / Electrex / Enercon / CIRCUTOR |
| 34 | Control Cables | : | KEI / POLYCAB / RR CABLE / HAVELLS |
| 35 | Battery charger | : | AMERON/ EXIDE/AMCO/ARMARA RA-JA |
| 36 | ATS/SPD | : | L & T / ABB / SCHNEIDER /SIEMENS/LEGRAND/HAGER |
| 37 | DAY Light/ OCCUPANCY Sensor | : | LEGRAND/SCHNEIDER/ABB/JONSHO N CONTROL/HAGER/WIPRO/LUTRON |
| 38 | MV PANEL | : | TTA/CPRI FABRICATORS WITH PAN-EL CLEARED BY CPRI. |
| 39 | ANGLE IRON/CHANNEL IRON | : | SAIL ,TATA, JINDAL |
| 40 | EARTHING | : | Ashlok, Indelec, Doksun, LPI |
| 41 | NETWORK RACK | : | NETRACK/WQ/PANDUIT/RITTAL/EME RSON/VALRACK |
| 42 | GI PIPE | : | TATA/JINDAL/ZENITH/SURYA/SAIL |
| 43 | CELING ROSE | : | ANTEX/LEADER/EMPEROR/ANCHOR |
| 44 | WEATHER PROOF BOXES | : | HANSEL/LEGRAND/OBO BETTER-MAN/C&S |
| 45 | ELECTRIC INSULATION MAT | : | DOZZ/PADMINI/RAYCHEM/JYOTHI RUBBER UDYOG |
| 46 | TELEPHONE JACK | : | BELDEN/SYSTIMAX/PANDUIT/SIEMON |
| 47 | HDMI Cable | : | Crestron / Extron / Kramer / Beldan/ Lightware/AMX/Nt |
| 48 | HRC FUSES | : | L&T/siemens/Alstom/GE |

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| | | |
|----|---|--|
| 49 | FUSE SWITCH UNITS/DISCONNECTING SWITCH FINAL UNITS | L&T/siemens/Alstom/GE/Legrand/Merlin Gerin |
| 51 | All others items not Covered Above | As per approval of the project Archi- tect & Bank |

1. TESTINGS

At the completion of the work, the contractor shall carry out the pre-commissioning as well as commissioning checks as given below on the entire installation and records be maintained for reference of any statutory authority, Client or their representatives.

2. Pre- Commissioning Checks

Note - Pre- Commissioning checks are to be carried out by Electrical contractor in presence of Project Management Team including Project Architect/consultant.

| Component | Points to be checked |
|---------------------------------------|---|
| Wires | <ul style="list-style-type: none"> ◆ Correct identification of each wire by continuity check and providing correct ferrules as per approved drawings. ◆ Correct colour coding and correct connection by proper copper lugs. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ IR values of the circuit are measured and recorded. |
| Switch boxes & Receptacles | <ul style="list-style-type: none"> ◆ Wires are connected properly as per wiring diagram. ◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ Earthing connection is made properly. ◆ Functional check is OK ◆ IR values of the circuit are measured and recorded. |
| Panels | <ul style="list-style-type: none"> ◆ External cables are glanded properly. ◆ Wires are connected properly as per wiring diagram. ◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ Two Earthing connections are made properly. ◆ Functional check is OK ◆ IR values of the circuit are measured and recorded. ◆ Check proper mechanical operations of circuit break- |

- ing devices including alignment of trolley for draw out type device.
- ◆ Check contact alignment. And proper sequence of closing and opening of main and arcing contacts.
 - ◆ Check electrical relays, meters & controls for correct wiring.
 - ◆ Check polarity and connections of all instrument transformers.
- Light fittings**
- ◆ Correct colour coding and correct connection by proper copper lugs is done.
 - ◆ Connections are properly tightened.
 - ◆ Not more than two wires are connected on any one side of terminal.
 - ◆ Earthing connection is made properly.
- Cables**
- ◆ IR values of the circuit are measured and recorded.
 - ◆ Cable identification tags are provided at both ends.
 - ◆ Cable entry in all equipment is through proper sized glands.
 - ◆ Cable termination is made by proper crimping type lugs.
 - ◆ Connections are properly tightened.
 - ◆ Not more than two conductors are connected on any one side of terminal.
 - ◆ IR values of the circuit are measured and recorded.
- Earthing**
- ◆ The resistance value of each earth electrode are measured and recorded.
 - ◆ Total resistance of earthing system should be as per the design value and in any case, shall not be more than 1 Ohm as per IS-3043.
 - ◆ Continuity test for earth continuity conductors with ELV tester

COMMISSIONING CHECKS

Note –Commissioning checks are to be made in following sequence starting from main panel to last light fitting. All results of testing and observations are to be preserved for record and reference by any statutory authority.

| Component | Points to be checked |
|---|---|
| Main LT panel & HVAC Panel, Utility Panel | <ul style="list-style-type: none">◆ All rectification points are attended and correctly rectified.◆ Incoming line voltage is correct as per panel incoming meter or checked by tong tester.◆ Energize only control circuits and carry out closing and tripping operations (where AC supply is derived from main supply and used for operation, the switch gear bus may be energized).◆ Check operation of electrical interlocks.◆ Check tripping of breaker by manual operation of relay.◆ Check operation of mechanical closing and tripping devices.◆ If incoming line voltage is correct, switch on outgoing feeder one by one and note that each one is kept ON for 5 – 10 minutes without any problem. |
| Switch boxes & Receptacles | <ul style="list-style-type: none">◆ All rectification points are attended and correctly rectified.◆ Check the voltage with test lamp.◆ Switch on the circuit. |
| Light fittings | <ul style="list-style-type: none">◆ All rectification points are attended and correctly rectified.◆ Switch on the circuit. |
| Earthing | <ul style="list-style-type: none">◆ Check if all earth electrodes in earth pits for its correct installation and connection to earth grid.◆ Check if all protective conductors from the earth electrodes to grid and from grid up to all electrical equipment are made correctly.◆ Remove the protective conductor / grid connection with earth electrode and measure earth electrode resistance by using earth megger.◆ Repeat above procedure for all electrodes.◆ Ensure that total earth resistance of the installation is less than 1 mega- ohms. |

Volume –IV

**TECHNICAL SPECIFICATIONS
FOR
DATA CABLING & NETWORKING
WORKS**

KVM SWITCH

Must meet the following performance specifications:

Integrated LCD display, keyboard, mouse and switch, 18.5-inch LED energy-saving display, Scissors feet ultra-thin keyboard, The machine adapts the towline type protective design and signal cable design to avoid losses caused by repeated pumping, High quality dedicated slide rail, Overall 1U height, suitable for standard cabinet, installation, No need for software installation, can be operated directly from the computer, Automatic power protection design. When device is not in use automatically enters in protected mode

POWER DISTRIBUTION UNIT

Must meet the following performance specifications: Managed PDU, Monitor and control power at the server level, Color-coded breaker & phase to better manage the load balancing, 60 deg C operating temperature, Thin Form Factor Chassis – 53mm deep, 52mm wide to safely remove servers, Extra Flat Breakers to avoid accidental tripping, Universal Mounting System including clip feet and flexible button, rear & side mounting system, eGrip system to secure standard IEC cables, +/- 1% IEC Class 1 Billing Grade Accuracy

INTER-RACK CABLING

UTP CAT6 CABLE

Must meet the following performance specifications:

Technical Specifications for Network Infrastructure, bidders must indicate whether the goods and equipment offered are “Compliant” or “Non-Compliant” to the corresponding specifications prescribed by BCDA using this form.

PATCH PANEL

Must meet the following performance specifications: Modular design, compatible with Shielded or Unshielded solution, Max. Capacity: 24 connectors, Front Connection: Flush, Termination Area: Rear Material: Steel Must include 1pc generic horizontal cable manager per patch panel.

PATCH CORD

Must meet the following performance specifications: Stranded conductors improve Flexibility, Improved strain relief and a flexible boot for optimum protection in high-density installations, Exceeds TIA and ISO transmission and mechanical performance requirements, Patch panel patch cord must be 2 meters in length and light blue in colour compliant to TIA-606 colour shade Workstation patch cord must be 2 meters in length and light blue in colour compliant to TIA-606 colour shade

CABLING

UTP Patch Panel

Must meet the following performance specifications: Modular design, compatible with Shielded or Unshielded solution, Max. Capacity: 24 connectors, Front Connection: Flush, Termination Area: Rear, Material: Steel Must include 1pc generic horizontal cable manager per patch panel

Modular Connector

Must meet the following performance specifications: Plug housing: polycarbonate, Conductor Type: solid; stranded, EIA Specification: EIA - 364, EU RoHS Compliant, Must have external boots

Power Distribution Unit

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Must meet the following performance specifications: Shall have 6way 6/16 Amps output ports multi standard socket, Shall be horizontally mounted, Power cord must be 2meters in length, Capable to mount directly to the rack or cabinet using cage nut

Fiber Patch Panel

Must meet the following performance specifications: Fiber Patch Panel, that can accommodate LC duplex adapter and LC connectors, Fiber Patch Panel should be can fit 2 fiber to terminate up to 48-fiber in 1RU, Typically used in Server rooms, Network rooms, Data Centres and Small offices, Can be mounted directly on any 19" rack or cabinet, Must have 12-fiber LC duplex adapter as Load.

Fiber Connector - Pigtail (LC – OM3)

Must meet the following performance specifications: Must have LC type Connector, Optical Characteristic: OM3, Telecommunication Standards: TIA-568.3-D, Connector Standards: IEC 61754, TIA 604,

Fiber Patch cord

Must meet the following performance specifications: Standard Length: 2 meters, *Patch cords* Conforms Standard: TIA/EIA 568 C.3, Fiber type: OM3, Connector 1: LC-LC, Cable Construction: duplex, Conforms Standard: TIA/EIA 568 C.3, Fiber type: OM3, Connector: LC - LC, Cable Construction: duplex

CAT 6 UTP CABLES APPLICATION

Enhanced performance cable for transmission of high Speed data. digital and analogue voice and video (RGB) Signal on LANs. This cable well exceeds the requirement of ANSI/TIA-568-C.2 category-6 ISO 11801

PREFERRED MAKE: SHOULD BE OF REPUTED MAKE (VIZ. LEGRAND /D-LINK /MOLEX)

CONSTRUCTION

| | | | |
|----------------|-----------------------------------|--------------------------|--------------|
| Conductor | 23 AWG Solid Bare Copper (4 Pair) | Electrical Properties | |
| Insulation | High Density Polyethylene | Characteristic impedance | 100+15 |
| pairs | 2 Insulated Conductors | Conductor Resistance. | < 9.6 /100m |
| | | Insulation Resistance. | 100m |
| sheath | FR-PVC | Mutual Capacitance | < 5.6Nf/100M |
| Cable diameter | 6.1 mm nominal | Capacitance unbalance | 330pf/100m |
| | | Delay skew | <45nS |

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| | | | |
|----------|---|---------------------|-----------------------|
| Printing | Each meter printed with sequential length counter | NVP (%): | 69% |
| | | Operating voltage | 72V |
| | | Dielectric strength | 1.0KV dc or 0.75kv ac |
| | | | For 1min |

CONNECTION SYSTEM

Compatible with all common systems according to TIA/ELA 568-C.2 and ISO/IEC 11801 Class E

PACKING

Reels of guaranteed 305m length

UTP KEYSTONE JACKS

Cats keystone Jacks, Category 6 suitable for 22-26 AWG stranded and solid wire, compatible toolless connector. They are capable of re termination. They are available in universal labels color coded for T568A and T568B wiring schemes and fit in high density keystone patch panel. It supports IEC 60603-7-4 and complied with ANSI/TIA/EIA-568-C.2 standard.

SPECIFICATIONS

| | |
|------------------------|--|
| RJ45 JACK: | HOUSING:ABS=PC,UL94V-0 |
| Contact bracket: | PC, UL 94V-2,transparent color |
| PCB MATERIAL: | FR-4 T = 1.2MM |
| RJ45 JACK CONTACT; | Material – phosphor bronze with Nickel plated Finish:50 micro-inch gold plated on plug |
| | Contract area |
| IDC: | Housing-PC+ glass fiber,ul 94v-2 Terminal: phosphor bronze with tin plated |
| IDC CAP: | ABS,UL 94V-0 |
| Insertion cycles | 750 times |
| IDC life: | 200 time min |
| Wire: | AWG 22-24 |
| Operating temperature: | AWG 22-24 |
| Storage temperature: | -10°C TO 80°C |
| Current Rating: | 1.5A |
| Insulation resistance: | >100 Megaohms |

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Contact Resistance

Variation: 20 milliohms

Insertion force; 20N (Max)

CAT 6 UTP IO

Material

| | |
|------------------------|--|
| Shielded case: | Copper C2860,T = 0.25MM,30U",Nickel Plated |
| Keystone jack Housing: | ABS High |
| Contract holder: | Pc = ABS Polymer High impact ul94V-0 Thermoplastic |
| Spring wire: | Phosphor bronze 5100W temper wire $\varnothing = 0.45\text{mm}$ |
| | 30" A0 / 300" PDNI over 600" Nickel undercoat |
| IDC Plastic: | Polycarbonate resin high – impact ul94V-0 Thermoplastic |
| IDC Contact | Phosphor bronze C5 191R-H,T=0.4MM,2000"YIN Over 600"Nickel undercoat |

PHYSICAL CHARACTERISTICS

| | |
|------------------------|---|
| Insertion life: | 750 Mating Cycle With FCC Compliant 8P Plug |
| Contact force : | 100 Grams With FCC Compliant 8P Plug |
| Durability: | 5 and above Termination cycles |
| Contact compatibility: | Accommodates 22 to 24 AWG Solid |

ELECTRICAL

| | |
|------------------------|----------------|
| Insulation Resistance: | 500 m Ω |
| DC Current Rating: | 1.5 Amps |
| Contact Resistance: | 20m Ω |

PHYSICAL CHARACTERISTICS

CAT 6 UTP PATCH PANELS

CAT 6 UTP LOADED PATCH PANEL

Category 6 patch panels are six port RJ45 modules applied and suitable for 22-26AWG stranded and solid wire, compatible toolles connector patch panels have improved Cable Management with optional Cable Management bar terminating 4 pairs UTP cable. They are complied with the ANSI/TIA/EIA-568-C.2 & ISO 11801 standard

SPECIFICATION

| | |
|----------------|---|
| Identification | ID plate PC, transparent color with paper |
| Panel | SPCC,1.5mm thickness with black color painted |

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| | |
|------------------------|--|
| RJ45 Jack: | Housing PBT+ Glass fiber ul94V -0 CONTRACT Brackets: PBT + glass fiber ul94v-0 Black color |
| RJ45 Jack contact: | Material-phosphor bronze with nickel plated Finis;50 micro – inches gold plated on Plug contact area |
| Jack Bracket set: | ABS |
| Support | SPCC,1.5 mm thickness with black Color painted |
| Size: | 1U |
| Cable manager: | 19" rack mountable, metallic high strength with Metal jumper rings for routing cable assemblies, Mounts to the front of 19" rack & 1U height |
| Contact resistance: | 20 milliohms max. |
| Insulation resistance: | 100 megaohms min.@ 500 VDC |
| RJ45 Jack Life: | 750 times min |
| IDC LIFE | 5times and above times min |
| Storage: | -40°to +70° |
| Operation | -10°to + 60° |

STRUCTURED CABLING SOLUTIONS

INTRODUCTION

These cables exceed performance requirements specified by the TIA/EIA-568B.2 / TIA/EIA-568C.2 and IEC 60603-7-4 standards.

Highlights

Conforms to DIN 41494 OR equivalent ISO Standards, Adjustable 19" equipment mounting verticals, provide the better mounting flexibility maximising the usable mounting space, Depth adjustable mounting slots, Precision engineering capabilities and best efficient software configuration product technology provides the best product quality and fastest delivery in the industry

Floor Standing Steel Enclosure is designed for Servers, Networking, Data Centers, Audio Video, Telecom and Lab applications. Enclosures are fabricated out of CRCA steel, CNC programmed, punched, bended, welded and Powder coated with highest quality standards.

Configuration for standard Racks is welded frame with 4 pillars of Multi Fold profile welded to top and bottom panels. 2 Pair Depth rails to additionally support the Enclosure. Removable side panels partially vented for better air circulation. Openings/Cut outs for field cable entry from Top & Bottom of the Rack. Vented top cover with fan mounting provision, Front Glass or perforated Metal door with lock and key. Back Vented, perforated or perforated Dual metal door with lock and key. Free Floor standing Design with 4 No. castor wheels 2 no's with breaks and 2 no's without breaks. Levelers or Plinth can be provided on request.

Racks are available in 17U to 42U Variants with 650mm/800mm/1000mm deep configuration and 600 and 800 width configurations.

External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

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Features:

Top and Bottom panel with ventilation and cable entry facility, Provision to mount the cooling fans on the top panels, Powder coated finish with pretreatment process meeting all industry standards, Grounding and Bonding Options, 100% assured compatibility with all equipment conforming to DIN 41494, General industrial standard for equipment.

Technical Data:

Rack Standard : Conforms to DIN 41494 or equivalent standard
Construction : Welded OR CKD (Knock Down)
Front Door : Lockable Toughened Glass Door,
Rear Door : Single Vented Steel
Basic Frame : Steel
Equipment Mounting: DIN Standard 10mm Sq. Slots / Direct M6 Tap
Mounting Angle : 19" Mounting angles made of formed steel
Standard Finish : Powder Coated
Top and Bottom Cover: Welded to Frame, Vented and Field Cable entry exit cut outs
Mounting Option : Castor wheels (Front 2 wheels with Break and rear without break) Or Levelers or Base plinth
Standard Color : Black or Grey
Static Load : 300+ kgs

Technical BOM:

| SR | Description | UOM | Qty |
|----|---|-----|-----|
| 1 | Basic Rack | | |
| | 27U Rack Frame-600X1000-STEEL | Nos | 1 |
| | Casters Set of 4 | Nos | 1 |
| | Adjustable Levelers set of 4 | Nos | 1 |
| | Glass Door-600-27U Front | Nos | 1 |
| | Metal Door-600-27U-Vented | Nos | 1 |
| | Side Panels-1000-27U-Vented | Nos | 1 |
| | Mounting Hardware-(Pack of 20) | Nos | 1 |
| | FHU with 2 FAN 180CFM | Nos | 1 |
| | Horizontal Power Distribution Unit with 6 x 5/15A sockets Round Pin, 230 Volts AC, 16 Amp with Plug | Nos | 1 |
| | Horz. Cable Manager-1U-Loop | Nos | 1 |

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Features:

Conforms to DIN 41494 OR equivalent ISO Standards, Adjustable 19" equipment mounting verticals provide the better mounting flexibility maximising the usable mounting space, Depth adjustable mounting slots, Precision engineering capabilities and best efficient, software configuration product technology provides the best product quality and fastest delivery in the industry, Top and bottom Panel with ventilation and cable entry facility, Provision to mount the cooling fans on the top panel, Powder coated finish with pretreatment process meeting all industry standards, Grounding and Bonding Options , 100% assured compatibility with all equipment conforming to DIN 41494. General industrial standard for equipment

Technical Data:

| | |
|----------------------|--|
| Rack Standard | : Conforms to DIN 41494 or equivalent standard |
| Construction | : Welded Frame |
| Front Door | : Lockable Toughened Glass Door, |
| Rear Door | : Steel Perforated |
| Basic Frame | : Steel |
| Equipment Mounting | : DIN Standard 10mm Sq. Slots / Direct M6 Tap |
| Mounting Angle | : 19" Mounting angles made of formed steel |
| Standard Finish | : Powder Coated |
| Top and Bottom Cover | : Welded to Frame, Vented and Field Cable entry exit cut outs |
| Mounting Option | : Castor wheels (Front 2 wheels with Break and rear without break) with Levelers |
| Standard Color | : Black or Grey |
| Static Load | : 500+ kgs |

Standard Accessories:

- Doors & Side Panels
- Power Distribution Units.
- Cable Manager.
- Fans and Fan Modules.
- Jacking Feet
- Mounting Hardware

Orderable Accessories:

- Fixed Shelf
- Sliding Shelf
- Key Board Shelf
- Cable Basket
- Rack Grouting Kit
- Cantilever Shelf

FACEPLATES

Offers a range of high quality, stylish designed Faceplate for professional installations, fully compliant for copper cabling system. The faceplate are inbuilt with shutters which are compatible with any standard coloured keystones jacks. The faceplate are available in one, two and four port variants.

Volume –V

**TECHNICAL SPECIFICATIONS
FOR
FIREFIGHTING WORKS**

TECHNICAL SPECIFICATIONS FOR SUPPLY AND ERECTION OF FIREFIGHTING SYSTEM FOR “EXTERNAL & INTERNAL RENOVATION OF LHO BUILDING (2ND TO 5TH FLOOR), BHUBANESWAR

A. ADDRESSIBLE FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- 1) The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- 2) The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones and shall include provisions for the system operator to override automatic messages system wide or in selected zones.
- 3) The system shall support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.
- 4) Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

1.2 SCOPE

- 1) A new intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance with the project specifications and drawings.
- 2) Basic Performance:
 - a) Alarm, trouble, and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Class A Signaling Line Circuits (SLC).
 - b) Device Circuits (IDC) shall be wired NFPA Class A as part of an addressable device connected by the SLC Circuit.
 - c) Notification Appliance Circuits (NAC) shall be wired NFPA Class A as part of an addressable device connected by the SLC Circuit.

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- d) On Class A configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- e) Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- f) Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
- g) NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
- h) Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
- i) NAC speaker circuits and control equipment shall be arranged such that loss of anyone (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
- j) Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
- k) Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
- l) Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
- m) Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B, or two Class A circuits.
- n) Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
 - i.) The digital amplifier shall automatically broadcast the stored audio message.
 - ii.) The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
 - iii.) Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
 - iv.) Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and over **25** remote Fire Fighter's Telephone locations simultaneously on a conference in multiple FFT Risers.

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- v.) Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
- vi.) The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.
- o) The proposed product shall not require any proprietary dongle or other programming tools for after sales & maintenance activity. If required, supply shall include necessary software & hardware, with lifetime validity, for programming the panel with all necessary license at no additional cost.

1.3 DESIGN INTENT

- a) Main fire alarm panel with digital voice command system, Fire fighters' telephone, amplifier, zone selector keypad and announcement console– in Ground Floor BMS Control room
- b) Secondary fire alarm panels/ Repeater Panels- At each building ground floor near lift lobby
- c) Active repeater panels at all entry exit gateways, monitoring stations and security cabins
- d) All fire alarm panels connected as peer to peer.
- e) Fire survival cables (750 deg. 2 hours)
- f) Class - A cabling to loop all detectors, devices & MCP"s to control panel.
- g) Coverage per detector as per NFPA -2015, considering > 60 ACH
- h) System integration (Soft integration) with all standalone panels such as agent release panels for deluge valves, Pre-action panels, lift switchboard, DG fresh air switch-board, etc.
- i) k) Addressable VESDA (Very Early Smoke Detection Apparatus) or equivalent technology with sensitivity of 0.02%obs/ft to be used in all Critical areas such as UPS Room, Battery Room, Server Room, MRI/CT/Xray Rooms, Record Room, etc.
- j) m) Addressable CO+IR Detector to be used in the areas with highly flammable substances such as Chemical Laboratories, Laundries/Washing Areas, DG Rooms, Chemical/ Oil Storage Areas, Lift Mechanical rooms, etc.
- k) n) Addressable Duct Detectors having 0.02% obs/ft sensitivity to be installed in all the return air ducts.
- l) Fire alarm system to have inbuilt capability of Addressable Wireless Smoke/Heat/Multi Detectors for use in the areas with low accessibility for cabling /maintenance & also the provision to add in future without the need of cabling.
- m) Seamlessly Integrated Public Address Voice Alarm (PAVA) system, integral with the Main FACP, including voice alarm system components, microphones, digital amplifi-

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ers, 2W UL Speakers, zone selector keypads and tone generators to be provided of same make as of Fire Alarm System.

- n) Emergency communication system, integral with the Main FACP, including voice alarm system components, microphones, amplifiers, zone selector keypads and tone generators
- o) Audible Alarm Notifications
- p) Fire fighters telephone system as part of main fire alarm system, which is two-way, supervised voice communication proposed to link between the MFACP and remote fire fighters' telephone stations throughout the building (at all staircases at all levels)
- q) Required loops with 24 hrs. Battery backup with LCD display, printer etc. shall be in the fire control room.
- r) Fire Alarm Panels shall be integrated with BMS also via MODBUS/ BACNET over IP
- s) Fire alarm system to have inbuilt capability to monitor & control the system remotely over cloud. Necessary hardware shall be part of the main FACP.
- t) Fire Alarm Systems shall be programmable from the Panel itself without the need of any special tools, dongle, or any software.

1.4 GENERAL INSTRUCTIONS

- a) Protect from moisture by using appropriate coverings. Store at dry interior locations.
- b) Sequence work to avoid interferences with building finishes and installation of other products.
- c) Supply as maintenance stock, consumable devices, components as recommended by Supplier, but shall not be less than two units of each type/ rating of installed consumable material/ component/ device.
- d) For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

1.5 WARRANTY

- a) The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 12 months.

1.6 APPLICABLE STANDARDS AND PRODUCT APPROVALS

- a) The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
- b) National Fire Protection Association (NFPA):

| | |
|---------|---------------------------------------|
| FPA 12 | Extinguishing Systems (low and high) |
| NFPA 13 | Sprinkler Systems |
| NFPA 15 | Water Spray Systems |
| NFPA 16 | Foam / Water Deluge and Spray Systems |
| NFPA 17 | Dry Chemical Extinguishing Systems |

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| | |
|-----------|---|
| NFPA 17A | Wet Chemical Extinguishing Systems |
| NFPA 2001 | Clean Agent Extinguishing Systems |
| NFPA 70 | National Electric Code |
| NFPA 90A | Air Conditioning Systems |
| NFPA 92A | Smoke Control Systems |
| NFPA 92B | Smoke Management Systems in Malls, Atria, Large Areas |
| NFPA 72 | National Fire Alarm Code |
| NFPA 101 | Life Safety Code |

c) Underwriters Laboratories Inc. (UL):

| | |
|----------------------------------|--|
| UL 268, 7 th Edition | Smoke Detectors for Fire Protective Signaling Systems |
| UL 864, 10 th Edition | Control Units for Fire Protective Signaling Systems |
| UL 2572 | Mass Notification Systems |
| UL 217 | Smoke Detectors, Single and Multiple Station |
| UL 228 | Door Closers - Holders for Fire Protective Signaling Systems |
| UL 268A | Smoke Detectors for Duct Applications |
| UL 521 | Heat Detectors for Fire Protective Signaling Systems |
| UL 464 | Audible Signaling Appliances |
| UL 38 | Manually Actuated Signaling Boxes |
| UL 1481 | Power Supplies for Fire Protective Signaling Systems |
| UL 346 | Waterflow Indicators for Fire Protective Signaling Systems |
| UL 1076 | Control Units for Burglar Alarm Proprietary Protective Signaling Systems |
| UL 1971 | Visual Notification Appliances |
| UL 2017 | Standard for General-Purpose Signaling Devices and Systems |
| UL60950 | Safety of Information Technology Equipment |

d) Factory Mutual

e) Local and State Building Codes. (IS189)

f) All requirements of the Authority Having Jurisdiction (AHJ).

g) The system shall be certified for seismic applications in accordance with the International Building Code (IBC). The basis for qualification of seismic approval shall be via shake table testing.

- h) The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the 4-20 monitor module and industry standard 4-20 mA gas detectors.

PART 2.0 PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

- a) Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.
- b) In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
- i.) Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 - ii.) Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 - iii.) Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.

2.1.1 System Capacity and General Operation

- A. The FACP shall communicate on a network, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mbps and support over 150 panels / nodes per network.
- B. The control panel shall be capable of expansion via up to 10 SLC loops. Each loop shall support minimum 120 detectors + 120 device excluding 20% spare. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 600-character liquid crystal display or 10-inch colorful touchscreen display, individual, color coded system status LEDs, and a Self-programmable alphanumeric keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either company.
- C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.
- D. The FACP shall be able to provide the following software and hardware features:
- a) Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

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- b) Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
- c) Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
- d) Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
- e) The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
- f) Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
- g) NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
- h) Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
- i) On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
- j) History Events: The panel shall maintain a history file of at least last 3000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 3000-event history file.
- k) Smoke Control Modes: The system shall provide means to perform Fire Smoke Control Station mode. This mode controls all dampers, smoke extraction fan, fresh air supply fans, etc. during Fire condition. Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
- l) The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
- m) Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be as-

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signed access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

- n) Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
- o) Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
- p) Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
- q) Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
- r) Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
- s) Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
- t) Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
- u) ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
- v) NON-FIRE Alarm Module Reporting: A point with a type of ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation, nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
- w) Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so

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that Mass Notification/Emergency Communications events take precedence over fire alarm events.

- x) Security Monitor Points: The system shall provide means to monitor any point as a type of security.
- y) One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as Control by Event and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pulling station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
- z) Control by Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
 - aa) Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
 - bb) 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
 - cc) 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
 - dd) 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
 - ee) Control-By-Time: A time-based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24-hour time schedule on any day of the week or year.

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- ff) Multiple agents releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
- gg) Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period.

E. Central Processing Unit

- a. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYX, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory and shall not be lost with system primary and secondary power failure.
- b. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
- c. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
- d. The CPU shall provide an RS-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
- e. The CPU shall provide two RS-485 ports for the serial connection to annunciation and control subsystem components.
- f. The RS-232 serial output circuit shall be optically isolated to assure protection from earth ground.
- g. In the event of CPU failure, all SLC loop modules shall fallback to Failsafe mode. Systems not offering failsafe mode shall offer Redundant CPU. Such failsafe mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits and the integrated voice evacuation system.

F. Display

- a) The system display shall provide a 600-character backlit alphanumeric Liquid Crystal Display (LCD) or 10inch Colour Touch Screen. It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.

- b) These characters shall be only for fire alarm / trouble information and not for Logo or other purpose. It shall be UL Listed. Repeater panel displays in FACP is not allowed unless until approved by UL
- c) The system display shall provide a Self-Programming keypad for ease of operation.
- d) The keypad shall have control capability to command all system functions, entry of any alphabetic or numeric information, and field programming without the use of any external equipment or laptop. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

G. Loop (Signaling Line Circuit) Control Module:

- a. The control panel shall be capable of expansion via up to 10 SLC loops. Each loop shall support minimum 120 detectors & 120 devices excluding 20% buffer for a system capacity of 2880 points including buffer.
- b. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
- c. Each loop shall maintain 20% spare capacity for future expansion.
- d. Each Loop shall be capable of operating as a NFPA Class B circuit in case of single open circuit fault in existing SLC Circuit
- e. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

H. Network Communication

- a) The FACP shall communicate over a peer-to-peer communication network, inherently over a regenerative communication format and protocol. The network shall support communication speed up to 100 Mbps and support over 150 Control Panels / Network Nodes, over a single medium (copper conductor / fiber optic), redundant ring, communication channel for fire alarm, voice evacuation and telephone talk-back system. The system shall support over 150 such networks in a single system.
- b) The network card shall have inbuilt Fiber port for terminating Fiber Optic Cable without any third-party converters.

I. Digital Voice Command Center

- a) The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, tel-
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ephone circuit indication and control, digital voice units, microphone, and main telephone handset.

- b) Function: The Voice Command Center equipment shall perform the following functions:
- i.) Operate as a supervised multi-channel emergency voice communication system.
 - ii.) Operate as a two-way emergency telephone system control center.
 - iii.) Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
 - iv.) Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
 - v.) Provide all-call Emergency Paging activities through activation of a single control switch.
 - vi.) As required, provide vectored paging control to specific audio zones via dedicated control switches.
 - vii.) Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
 - viii.) Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
 - ix.) Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
 - x.) The Digital Voice Command shall be modular in construction and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
 - xi.) The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.
 - xii.) Fire, Voice & Telephone data shall flow through single network cable.
 - xiii.) The Voice Evacuation System shall be capable of establishing communication between the master voice controller and amplifier over fiber optic cable network without using any third-party media converter.
 - xiv.) Failure of Fire Panel CPU shall not affect the operation of DVC. In case DVC / Amplifiers are controlled by Fire Panel CPU, a separate panel with dedicated CPU shall be considered for each DVC & Amplifier.
 - xv.) The Fire Fighters Telephone System shall be capable of having minimum 25 Telephones in conference in multiple FFT Risers

J. Power Supply

- a) The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
- b) The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual rate charging techniques for fast battery recharge.
- c) The Main Power Supply shall provide a battery charger for 24 hours of standby using dual rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
- d) The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
- e) The Main Power Supply shall be power limited per UL864 requirements.
- f) The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunciated and logged to the system alarm history log.
- g) The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
- b) The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
- c) The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
- d) The addressable power supply shall have an option for Trouble Reporting and this option shall be programmable.
- e) The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
- f) Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
- g) The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

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- h) When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
- i) When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
- j) The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
- k) An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

- a) The Audio Amplifiers shall provide Audio Power for distribution to speaker circuits.
- b) Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
- c) The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
 - i.) Earth Fault Detection & Annunciation for Communication bus
 - ii.) Audio Amplifier Failure Trouble Annunciation
 - iii.) External trigger input indication in case of Amplifier failure
 - iv.) Audio Detected on Firefighter's Telephone Riser
 - v.) Receiving Audio from digital audio riser
 - vi.) Short circuit on detection & annunciation on each speaker circuit
 - vii.) Communication Status
 - viii.) Board failure
 - ix.) Active fiber optic media connection
 - x.) Power supply monitoring of below conditions – Earth fault, Low Battery, Charger Trouble
- d) Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
- e) Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
- f) System shall be capable of backing up digital amplifiers.
- g) One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
- h) Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

- i) System shall support distributed architecture of voice evacuation system to enable remote installation of amplifiers to manage the sound attenuation problem & for the best sound intelligibility. Remote Amplifier's shall communicate with the centrally located Digital Voice Command.

L. Controls with associated LED Indicators

- a) Speaker Switches/Indicators
- b) The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
- c) The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
- d) Emergency Two-Way Telephone Control Switches/Indicators
 - i.) The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
 - ii.) The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

M. Field Programming

- a) The system shall be programmable, configurable, and expandable in the field without the need for dongle/ special tools. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
- c) All field defined programs shall be stored in non-volatile memory.

N. Specific System Operations

- a) Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
- b) Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

O. System Point Operations

- a) Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or Graphics User Interface.
- b) System output points shall be capable of being turned on or off from the system keypad or the video terminal.

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- c) Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
 - i.) Device Status.
 - ii.) Device Type.
 - iii.) Custom Device Label.
 - iv.) Software Zone Label.
 - v.) Device Zone Assignments.
 - vi.) Analog Detector Sensitivity.
 - vii.) All Program Parameters.
- d) System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing over 3000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
- e) The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
- f) Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
- g) If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the Intelligent Detector will be annunciated on the system display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools, or computer expertise to perform.
- h) The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.2 SYSTEM COMPONENTS

A. Network Control Annunciator

- a) A network control annunciator shall be provided to display all system intelligent points. The NCA shall be capable of displaying all information for 160000 points on the network. Network display devices, which are only capable of displaying a subset of network points, shall not be suitable substitutes.
- b) e NCA shall include 600 Character LCD Display or a 10inch (1024 x 600) Color touchscreen display with Alphanumeric Programming Keypad. Additionally, the network display shall include environmental adjustment controls to maximize LCD legibility and the ability to scroll events by type. i.e., Fire Alarm, Supervisory Alarm, Trouble, etc.
- c) The network control annunciator shall have the ability to display multiple events in order of priority and time of occurrence. Counters shall be provided to indicate the total number of events by type.
- d) The NCA shall mount in any of the network node fire alarm control panels. Optionally, the network display may mount in a backbox designed for this use and shall connect to the network over either a wire or fiber interface.
- e) The network control annunciator shall have an event history buffer capable of storing a minimum of 1000 events in non-volatile memory. Additionally, the NCA shall have a fire alarm history buffer capable of storing a minimum of 200

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events in non-volatile memory. Systems that do not protect fire alarm events from being overwritten by other events are not suitable substitutes.

- f) The NCA shall include Three USB connection, USB C, USB B Micro, and USB A, industry standard RS-232 ports for UL864 listed printers and CRT's. These peripheral devices shall print or display network activity.
- g) The network control annunciator shall include control switches for system wide control of Acknowledge, Signal Silence, System Reset, Drill, and local Lamp Test. A mechanical means by which the controls switches are "locked out", such as a key, shall be available.
- h) The NCA shall include long life LEDs to display Power, Fire Alarm, Pre-Alarm, Security Alarm, System Trouble, Supervisory, Signals Silenced, Disabled Points, Other (non-fire) Events, and CPU Failure.
- i) The network control annunciator shall include a Master password and up to nine User passwords. Each password shall be up to eight alpha-numeric characters in length. The Master password shall be authorized to access the programming and alter status menus. Each User password may have different levels of authorization assigned by the Master password.
- j) The NCA shall allow editing of labels for all points within the network; control on/off of outputs; enable/disable of all network points; alter detector sensitivity; clear detector verification counters for any analog addressable detector within the network; clear any history log within the network; change the Time/Date settings; initiate a Walk Test.
- k) The network control annunciator shall support an optional Windows TM based program utility. This utility shall allow the user to create an NCA database, upload/download an NCA database, and download an upgrade to the NCA executive. To ensure program validity, this utility shall check stored databases for errors. A compare function shall be included to identify differences between databases.
- l) For time keeping purposes the NCA shall include a time-of-day clock.

B. Network Control Station / Graphics User Interface

- a) The NCS shall utilize a Microsoft(tm) operating system. Each Network Control Station shall be capable of graphically annunciating and controlling all network activity and at least 2,50,000 network points. Network display devices that are only capable of displaying a subset of network points shall not be suitable substitutes.
- b) The NCS shall be an IBM (or compatible) personal computer with the following minimum requirements: Intel Pentium II (tm)-processor, operating at a minimum of 400 Mhz, 128Mbytes of RAM, 8 Mbytes Video RAM, 1.44 Mbyte floppy drive, 3.2 Gbyte hard disk, mouse, 32X CD-ROM, 3PCI / 1 ISA expansion slots, internal 3.2 Gbyte tape drive, sound card, 200-watt power supply, and SVGA graphics with a screen resolution of 1024 x 768. The network control station shall include a 19-inch monitor.
- c) The NCS shall be capable of storing over 100,000 network events in a history file. Events shall be stored on hard disk and shall be capable of back-up storage to a tape drive. The history buffer allows the operator to view events in a chronological order. A filter shall be available for displaying chronological events by operator, date, time, fire alarms, troubles (including security, supervisory and system/device), disabled points/zones, system programming, operator response and operator log in/log out. The ability to print NCS history files shall also be available.
- d) The NCS shall use a Windows(tm) dialog box technology to address, interrogate, control, and/or modify intelligent points on each fire alarm node. This shall include, and not be limited to: Activating outputs, enabling, or disabling points, adding or removing intelligent points, viewing intelligent detector sensitivity levels and modifying point information (custom messages, detector type, verification, day/night selection etc.)
- e) The NCS shall include the ability to display system information in a graphical (floor plan) form. Each view, created using standard Windows bitmap files, shall include icons created for intelligent devices. These icons shall blink and change to the appropriate programmed icon when an event occurs. When the device has been acknowledged, the icon shall become steady. Once the point has returned to normal, the normal icon is displayed. In addition to the graphical representation of the device, the user shall be able to link pictures, documents, and sound files to the device. The NCS shall also provide the ability to auto-vector to the floor plan (screen) of the device that is active. By selecting a device in the graphic presentation, the operator of the NCS shall have the ability to log onto the corresponding node and interrogate the associated intelligent point.
- f) The NCS shall have the ability to provide the following information through a Windows(tm) pull down menu: An Event Counter that contains the number of new and total events on the network. The information that is displayed shall consist of Fire Alarms, Pre-Alarms, Security Alarms, Supervisory Alarms, and Troubles. A Detailed Event window that contains all Off-Normal events, both unacknowledged and acknowledged that are present in the system. It shall contain two views, Fire events and Non-fire events that shall be user selectable. A Current Event window that shall contain all network and local events as well as system messages with a maximum of 1,000 events displayed. A Disabled Device window that shall contain all disabled devices in the system.

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- g) The NCS shall have the option, from a Windows pull down menu, to connect to a third-party paging service that allows the NCS to automatically send text-based messages regarding system status to a typical text pager.
- h) The NCS shall include help screens, available to aid the user without leaving the selected application screen.
- i) The NCS shall be UL-Listed for fire protection (UL864) and burglary (UL1076).
- j) The NCS shall interface with other panels as a node in the peer-to-peer network.
- k) The operator shall be able to monitor the FFT system from GUI software and shall be able to monitor and control Integrated Voice Evacuation System.
- l) The NCS shall have a flexible way of assigning operator passwords. There shall be an unlimited number of possible operators, each with specific levels of control. Each operator shall have his/her own password. Operator password and control selection shall be available to a high level "administrator" who shall have complete control over levels of control. If no action has taken place on the NCS after 10 minutes, the current operator shall be logged out and require a new log-in.
- m) The NCS shall include an industry-standard RS-232 port for a UL864 listed printer.
- n) The NCS shall be a tabletop hardware configuration.

C. Interactive Firefighters' Touchscreen Display

- a) The network will interface and report the individually monitored system's alarm status via a user-friendly Graphical User Interface (GUI) based software.
- b) The software shall operate under Microsoft® Windows® 7 or Higher Operating System in Embedded platform as manufactured by Microsoft Corporation.
- c) The GUI based software must be capable of graphically representing the facility being monitored with floor plans and icons depicting the actual locations of the fire alarm device locations. It shall be capable of mapping at least 2,50,000 network points
- d) The software shall use a 1280-pixel x 1024-pixel GUI display capable of showing a large primary floor plan display, a site plan representative of an aerial view of the facility, the first active fire alarm on the system.
- e) The software shall permit automatic navigation to the screen containing an icon that represents the first fire alarm device in alarm in the event of an off-normal condition.
- f) The fire alarm device icon shall be visible only when it is in an alarm (or active) condition.
- g) The software shall display the activated smoke detectors in a time sequence to track smoke progression.
- h) The software shall allow the importation of externally developed floor plans in Windows Metafile (WMF), JPEG (JPG), Graphics Interchange Format (GIF) and Bitmap (BMP) format.
- i) The software shall provide an intuitive and easy way to navigate to different screens representing floors and areas within a facility.
- j) The system shall provide for continuous monitoring of all fire alarm conditions regardless of the current activity displayed on the screen.
- k) The software shall display "YOU ARE HERE" along with icons representing standard building objects (stairs, elevators, etc) to be shown on the floor plan.

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- l) The software shall allow icons that represent hazardous materials stored in a facility.
- m) The software shall provide a screen that displays preprogrammed building contact information.
- n) The software shall provide a screen the displays building occupancy and other general building information.
- o) The software shall allow a site plan to be imported that shows an aerial view of the facility.
- p) The software shall display all active fire, supervisory, and security events within an event list.
- q) Bidders also have the option to propose UL Listed Software with UL Listed Industrial Grade Hardware to achieve this functional requirement.

D. Cloud Based Facility Management Software

Remote health monitoring solution utilizing cloud-based software-as-a-service web application & supplementary network gateway hardware. System shall provide secure web access to cloud-based web application using any of the web browsers like Google Chrome (preferable), Internet Explorer etc. from any computer/ tablet/ smartphone connected over internet via defined credentials – username and password. Supplementary FACP gateway hardware furnished in this section shall be programmable directly from the embedded webpage in the hardware, upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable. The cloud-based web application shall capture all fire alarm system data as received from the system via supplementary gateway hardware. Owner shall receive login and passwords at first training session. The Owner shall have full licensing and full access rights for remote monitoring system.

- 1. Cloud Based Application: The cloud hosted web application shall provide an intuitive user interface and shall provide the following features as a minimum:
 - 1. Real time view of fire system effectiveness
 - 2. Multi-location unified view
 - 3. Custom dashboard view
 - 4. Device level detailed information including current status.
 - 5. Event list
 - 6. System reports
 - 1. Fault Handling
 - 2. Device Replacement & contamination
 - 3. Panel & System report
 - 4. Custom reports
 - 7. Report export in PDF/ DOC format

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8. Report scheduler Settings – add, delete, modify email addresses.
9. Email ID settings for emailing critical alarms.
2. Web Browser Navigation: The cloud hosted web application shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using Google Chrome web browser to accomplish requirements of this specification. The Web application shall (as a minimum) provide for navigation, and for display of intuitive dashboards, device information, alarms/events, reports, configuration menus for report settings.
3. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.
4. Navigation: Navigation through the web application shall be accomplished by clicking on dynamic links on dashboards to access detailed system information and by clicking on appropriate tabs for application settings and preferences. Both the tabs and dynamic links shall be displayed simultaneously, enabling the operator to select a specific system information and application settings and preferences.
5. System Dashboards: The system dashboard shall provide several functional information for each system specified. This view shall be accessed by right after logging in to the system:
 1. Each building dashboard (in case of multiple buildings) shall be visible along with system effectiveness and fire alarm system information like –
 1. Number of panels
 2. Number of loops
 3. Number of devices
 2. Detailed information Section – this can be accessed upon clicking relevant links. Detailed system information like device list along with corresponding address, current status and time stamping can be viewed. Events data is also visible.
 3. Search: User shall have multiple options for searching data based upon device type, device status.
6. Reports: The Web application can be used to access system health reports of past and as-on-date. Provision for system reports to be emailed to predefined email IDs and time intervals in PDF or DOC format. Different report types –
 1. Fault Handling report – Effective measurement of turnaround time (TAT) of various issues and capable of drawing detailed report at individual fault level.
 2. Device Replacement Report - Proactive alerts along with active insights on

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the faulty devices & detectors which need attention or replacement helping customers save time and reducing fire risk.

3. Device Contamination Report - Real time statistics of device contamination showing dirt levels along with detector efficiency.
4. Panel & System Report - List of panel faults with trouble date and time stamped, beyond the panel memory of 4000 events can store upto 100,000 events.
7. Alarms: Alarms associated with a specific equipment or device, shall be displayed dynamically in a window.
 1. The Alarm remain in the application until it is acknowledged, or Panel is reset.
 2. The Alarm status also viewed in the LIST VIEW section of the application.
8. Security Access: Cloud hosted Remote monitoring web application for fire alarm system can be accessed by Google chrome web browser and shall require a Login Name and Strong Password. Separate access credentials for owner and service provider shall be provisioned.

2.3 GATEWAY AND WEB SERVERS

- A. Cloud based Modbus Interface Gateway: The system shall be capable of being interfaced with Modbus compliant clients. A Modbus interfacing communication shall be available from the fire alarm control panel manufacturer. Modbus shall support group of panels with respective data points/ object points. Modbus solution shall have UL listing.
- B. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.
- C. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.4 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using user friendly hard switches-which shall be enabled using non-complex tools. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain hard decimal address switches.
4. Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and pow-

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er/polling bi-colour LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
10. Detectors shall also store an internal identifying type of code that the control panel shall use to identify the type of device (PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
15. Detector Bases with connection terminals/addressing exposed to Ceiling shall be provided with Dust /Moisture Protective Insulation of the same make as of Detectors.

B. Addressable Manual Call Point (Break Glass)

1. Addressable manual call point shall send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type of reset.
3. Manual fire alarm boxes shall be constructed of Lexan / ABS Plastic with clearly visible operating instructions provided on the cover. The word FIRE / Fire Sign shall appear on the front of the stations.

C. Intelligent Photoelectric Smoke Detector:

The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

1. Designed to meet UL268 7th Edition.
2. Modern profile with White color for improved aesthetics.
3. Sensitivity Range of 0.5% to 4.0% obs/ft
4. Stable communication technique with noise immunity.
5. Low standby current. 200 micro-Amps @ 24 VDC
6. Two-wire SLC connection.
7. Hard decimal addressing
8. Dual bi-color LED design providing 360° viewing angle. LEDs blink green in normal condition and illuminate steady red on alarm
9. Remote test feature from the panel.
10. Walk test with address display
11. Built-in functional test switch activated by external magnet.
12. Built-in tamper-resistant feature.
13. Sealed against back pressure.
14. Expanded color options.
15. Optional relay, isolator, and sounder bases.

D. Intelligent High Sensitivity Photo Smoke Detector

The intelligent high sensitivity photo smoke detector shall be a spot type detector that incorporates an extremely bright high sensitivity diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor. This is applicable in critical areas like ICU, ICCU, ITU, OT, laboratories, Hub rooms, PAC rooms & data centers.

1. Designed to meet UL268, 7th Edition
2. The high sensitivity detector shall have conductive plastic so that dust accumulation is reduced significantly.
2. The intelligent high sensitivity photo detector shall have nine sensitivity levels

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and be sensitive to a minimum obscuration of 0.02 percent per foot.

3. The high sensitivity detector shall not require expensive conduit, special fittings or PVC pipe.
4. The intelligent high sensitivity photo detector shall support standard, relay, isolator and sounder detector bases.
5. The high sensitivity photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment, or specialized cleaning of the detector head shall not be required.
6. The high sensitivity photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Multi Criteria Detector

The intelligent multi-criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The detector design shall allow a wide sensitivity window, 0.5 to 4.0% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

1. Designed to meet UL268, 7th Edition
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

F. Intelligent Thermal Detectors

The intelligent thermal detectors shall be addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) or have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit (87.8 degrees Celsius) shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

1. Modern profile with White color for improved aesthetics.
2. Advanced thermal technology for fast response.
3. Fixed temperature model factory preset to 135°F
4. Rate of Rise model preset to 15°F/min
5. High temperature model factory preset to 190°F
6. Low standby current. 200 micro-Amps @ 24 VDC
7. Two-wire SLC connection.
8. Hard decimal addressing
9. Dual bi-color LED design providing 360° viewing angle. LEDs blink green in

normal condition and illuminate steady red on alarm

10. Remote test feature from the panel.
11. Walk test with address display
12. Built-in functional test switch activated by external magnet.
13. Built-in tamper-resistant feature.
14. Sealed against back pressure.
15. Optional relay, isolator, and sounder bases.

G. Intelligent Duct Smoke Detector

The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely.

I. Intelligent Addressable Aspiration Detector

The intelligent aspiration detector shall be an addressable aspiration detector that communicates directly with the fire alarm control panel via the SLC communication protocol, no modules or high-level interfaces shall be required. The aspiration detector shall have Infra-red laser optical smoke detection for a wide range of fire detection with enhanced immunity to nuisance particulates. The FACP shall be capable of monitoring and annunciating up to five smoke event thresholds and eleven trouble conditions. Each event threshold shall be capable of being assigned a discrete type of ID at the FACP. This is applicable in critical areas like Battery rooms, Hub rooms, PAC rooms, data centers and cold storages.

J. Intelligent Addressable Reflected Beam Detector

1. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a key switch; It shall be equipped with an integral sensitivity test feature.
2. The Beam Detectors shall be long range, projected beam type smoke detectors which consist of a Transmitter and receiver in a single unit and reflector on the other side.
3. The Beam Detector shall have a range up to 100 mtrs. There shall be multiple sensitivity levels. There shall be trouble alarm if obscuration block is more than 96 %.
4. The beam detector shall have onboard heater and shall have smart analytics & shall have CMOS imager instead of photo diode to avoid any kind of false alarm.
5. The beam detector shall be resistant to building moment, sunlight saturation &

foreign object intrusion.

K. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Class A or Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

L. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device)
2. The IDC zone may be wired for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

M. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances
2. The control module NAC may be wired for Class A/B with a current rating of 2 Amps
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

N. Addressable Releasing Control Module

1. An addressable releasing module shall be available to supervise and control compatible releasing agent solenoids
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Class A/B and support one 24 volt or two 12-volt solenoids.

O. Addressable 4-20 mA Module

Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display

1. The module shall support programming of up to five programmable event thresholds.
2. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

P. Addressable Relay Module

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1. Addressable Relay Modules shall be available for HVAC control and other network building functions
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relays control a module shall be available that provides 6 programmable Form-C relays.

Q. Addressable Two-In / Two-Out Monitor/Relay Module

1. An addressable Two-In / Two-Out module shall be available.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

R. Isolator Module

Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
4. **If Isolator Bases are proposed, Vendor needs to consider Isolator base for all detectors**

S. Serially Connected Annunciator

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. RS-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,000 points of annunciation.
2. An RS-485 repeater shall be available to extend the RS-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

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a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive RS-485 driven relays. This shall extend the system point capacity by 3,000 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

T. Speakers

1. The Speaker appliance shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

U. Hooter cum Strobes:

Notification Appliances shall have following features:

1. Three field selectable candela settings: 15, 75, and 115,
 2. Easy to use Hard dials for selection of candela and horn settings
 3. Built in synchronization feature keeps strobes in sync for up to 30 minutes,
 4. Strobes Listed to UL1638; Horns Listed to UL464,
 5. Horn settings on the horn strobe model include high and low volume, continuous or
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temporal 3 tone,

6. Round trim ring available for ceiling mount applications,
7. Universal Fire symbol is language independent,
8. Trim plate allows mini horn to mount to a variety of backboxes and fit aesthetically with the horn strobe and strobe.
9. Strobe rated at 80 dBA @ 3m for Audible annunciation

V. Addressable Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
2. 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.
3. The two-way emergency telephone system shall support thirty-five (35) handsets online without degradation of the signal.
4. Remote Telephone Handset shall be capable of making paging announcement across all the zones in the system.

W. Addressable Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support thirty-five (35) handsets online (off hook) without degradation of the signal.
4. Remote Telephone Handset shall be capable of making paging announcement across all the zones in the system.

X. Batteries

The battery shall have sufficient capacity to power the fire alarm system for not less than 48 hours in standby plus 2 hours of alarm upon a normal AC power failure.

The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

If necessary, to meet standby requirements, external battery and charger systems may be used.

PART 3.0 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports, and hangers shall be concealed in fin-
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ished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 CAUSE & EFFECT LOGIC

System shall be programmed as per the attached cause & effect logic.

3.3 TESTING

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all the adjustments and tests for the system. All testings shall be in accordance with NFPA 72.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 FINAL INSPECTION

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.5 INSTRUCTION & TRAINING

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.6 SUBMITTALS

a) Power calculations.

- i.) Battery capacity calculations.
- ii.) Supervisory power requirements for all equipment.
- iii.) Alarm power requirements for all equipment.
- iv.) Justification showing power requirements of the system power supplies.
- v.) Voltage drop calculations for wiring runs in worst case condition.

b) Complete manufacturer's catalogue data including supervisory power usage, alarm power usage, physical dimensions, finish, and mounting requirements.

c) Submit panel configuration and interconnection of modules and all other data as required to make an informed judgment regarding product suitability. As a minimum, data shall be submitted on the following:

- i.) Main system including all fire detection with main and secondary control panels.
- ii.) Circuit interface panels including all modules.
- iii.) Power supplies, batteries, and battery chargers.
- iv.) Equipment enclosures.
- v.) Intelligent addressable manual pull stations, multi-criterion detectors, heat detectors, analogue smoke detectors, alarm monitoring modules, and supervised control modules.
- vi.) Audible and visual evacuation signals and devices.
- vii.) Software and firmware as required providing a complete functioning system.
- viii.) Wiring.
- ix.) System driven remote annunciators.
- x.) Interface module and wiring configuration from local system to Fire Command System.

d) Submit copies of UL listing or FM approval data showing compatibility of the proposed devices or appliances and the panels being provided.

e) Submit the following shop drawings.

- i.) Floor plans showing all initiating, end of line, supervisory, indicating appliances, and output control devices; including circuit interface panels, enunciators, printers, Control panel location.
- ii.) Raceways, marked for size, conductor count with type and size
- iii.) Calculations and mathematical justification for audible devices shall meet the code requirement of 15 dBA above ambient at 10 feet distance for audible warning signals.
- iv.) Wiring diagrams showing points of connection and terminals used for all electrical connections to the system devices and panels.

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- v.) Complete single-line riser diagram showing all equipment and the size type and number of all conductors.
- f) Submit Method Statement for systems component wiring, installation, testing, commissioning, and operating.
- g) Typical installation drawings
- h) Complete operation and maintenance manual with two sets of proposed installation drawings shall be submitted.
- i) Warranty all system components, devices, peripherals, wiring, for Three years from date of practical completion Certificate.
- j) Guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for One years from date of practical completion Certificate.

B. PUBLIC ADDRESS SYSTEM

1. IP NETWORK CONTROLLER

- a) The Network Controller shall be TCP/IP Based 2x2 audio matrixes and shall handle minimum two independent 100V monitored line with 120W Class-D Digital Amplification per line/zone. The controller shall have Color touch screen interface for IP Address settings, programming, monitoring and fault indication. Controller shall have inbuilt monitored loudspeaker to listen different audio signal.
- b) IP Network Controller shall have inbuilt memory for MP3 or WAVE file, and it should support minimum 100MB storage or 200min messages. The Controller should have Dry contacts for Integration with Fire Alarm Control Panel for Automatic Voice Evacuation.
- c) The unit shall be powered by 230V AC or 24V DC source.
- d) Switching between two supplies shall take automatically in case of failure of anyone. Controller should be fully monitored for Power faults, Contact, and amplifier (gain) and 100V loudspeaker line (open, short-circuit impedance, leakage). Unit should support Automatic gain control function by connecting external microphone. IP Network controller should be directly connected on Ethernet LAN/WAN & should simultaneously decode two audio streams from IP / Ethernet network. The unit should support direct paging from remote IP microphone console over Ethernet. A single unit should work as IP Based Public address, Voice Alarm, Background Music, Message Scheduling with inbuilt amplification. System should support networking of minimum 400 IP Network

2. CONTROLLERS:

Approved make: -BOSCH/BOSE/ATEIS or equivalent.

Amplifiers: - The amplifier will be class D and should have the following minimum Specifications as below.

- i.) Should be inbuilt along with the controller and should support redundancy.
- ii.) If the amplifier is not in built, then the system should have the provision wherein external amplifier supplied should have provision for redundant amplifier in the ratio 1:1.
- iii.) System using amplifier switching not allowed.

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- iv.) Minimum wattage per zone would be around 100 watts.
- v.) No other category of amplifier except for class D would be accepted.
- vi.) The amplifier should have 3 band parametric EQ, if not the same should be available in the digital controller. Systems using only basic power amplifier will not be allowed

The system shall comprise of TCP/IP desk Intercom/Paging station with colour touch screen the screen shall be TFT colour screen 4.3 inches, including touch panel 16 buttons / page 100 pages Directory list, Microphone mute feature

Technical specifications: -

- i.) Ethernet interface including POE (Power on Ethernet)
- ii.) 24 VDC power supply (if no POE available)
- iii.) Monitored high quality gooseneck microphone
- iv.) Automatic gain control on microphone input
- v.) Monitored built in loudspeaker
- vi.) SPEEX/MP3 audio encoding/decoding
- vii.) Memory space for pre-recorded messages
- viii.) RJ9 plug for optional headset
- ix.) LED Power (green)
- x.) 2 monitored input contacts on Euro block screw terminals
- xi.) output contacts NO/NC
- xii.) Speaker: Power 4 W rms, Bandwidth 200 Hz-10 kHz
- xiii.) Microphone: Length 250 mms, bandwidth 100 Hz-10 kHz
- xiv.) Contact inputs: Active to ground, voltage 3.3 VDC
- xv.) Relay outputs: 48 VDC / 2A
- xvi.) Housing: Polystyrene shock, UL94 self-extinguishable,
- xvii.) Power consumption (24 VDC): 1.7 W standby, 7 W max

3. SPEAKER: 6 W CEILING MOUNTED META SPEAKERS WITH FIRE DOME

The speaker shall be suitable for flush mounting to a false ceiling of any configuration. It shall be equipped with a multiple tapping matching transformer to provide easy control of speaker sound volume. Supporting brackets to mount the speaker onto false ceilings of different configurations shall be provided. The speaker shall not have any screw fixing arrangement on its grill. The speaker must comply with BS5839 part 8 and having the EASE, CATT, ULYSSES files for sound acoustic calculation and sound modelling. All tapping shall be made to obtain SPL as per BS5839 part8 the speakers shall be complete with fire dome and thermal fusible link.

It shall satisfy the following performance characteristics.

- i.) 6" two-way speakers
- ii.) Effective frequency range according to BS6840 shall be 80-20,000Hz
- iii.) SPL @ 1m, 1Watt, dB, Test Signal Bandwidth 100Hz-10 KHz shall be 92dB
- iv.) SPL @ full power Octave Bandwidth shall be dB102
- v.) Rated Power, Watts 10 @ 10/5/2.5/1.25 tapings

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- vi.) Acoustic Power (dB-PWL @ 1watt) 1 KHz/2KHz, 89/88dB
- vii.) Directivity Axial Q factor, 1 KHz/2KHz shall be 2.3/4.2
- viii.) Dimensions, diameter 239mm
- ix.) Material shall be steel, white, RAL9016

Approved make: - Bosch, JBL, BOSE, Ateis, (In case OEM does not manufacture speakers they can take form any of the four approved makes but the speaker selected should be EN 54 -24 / BS 5829 part 8 compliant/UL. Not CE certifications not allowed)

4. 20 W HORN TYPE SPEAKERS

- i.) The Horn speaker unit shall have a 100-volt transformer sealed inside its high-strength, lightweight; ABS housing that is protected against the elements by molded-in UV inhibitors. Its wire enters the housing through a gland nut designed to keep the moisture out. Horns must have lightweight high-density, phenolic-resin diaphragms and ceramic magnets.
- ii.) Mounting shall be using epoxy-coated, stainless steel U bracket held in place by stainless steel hardware allowing its position to be maintained despite unusually high wind velocity.
- iii.) The Horn speaker should be tested in accordance to IEC60268 Part 5 for high quality intelligibility & shall comply to BS5839 part 8, hence fitted with ceramic terminals and thermal fuse. Unit shall consist of a weather-resistant ABS housing, high density phenolic resin diaphragm, internal 100-volt transformer, epoxy coated stainless steel mounting bracket, stainless steel hardware and 17 inches five conductor wire.

5. TECHNICAL SPECIFICATIONS

- i.) Rated power, Watts 20 W Tapping's 100volt line 20/10/5/2.5 W Transformer Impedance, Ohms, 100V 500k/1k/2k/4k
- ii.) Effective frequency range, Hz (BS6840) 250–8,000 S.P.L. @ 1m, 1 watt, dB,
- iii.) Test Signal Bandwidth 101 dB Full power Octave Bandwidth, dB 114 dB
- iv.) Dispersion at 1k/2kHz, Degrees 130 / 70 Directivity Axial Q factor, 1 k/2kHz 4.90 / 13.60 Dimensions, front & depth, mm Ø203 x 254
- v.) Colour/Finish Grey RAL7035
- vi.) Material ABS plastic housing with UV inhibitors Mounting Stainless Steel U Bracket
- vii.) IP Rating 66
- viii.) Approved make: - Bosch, JBL, BOSE, Ateis (In case OEM does not manufacture speakers they can take Form any of the four approved makes but the speaker selected should be EN 54 -24 / BS 5829 part 8 Compliant. Not CE certifications allowed)

6. MOLDED CABINET WALL-MOUNT LOUDSPEAKERS

- i.) The enclosure shall be ported and treated with UV inhibitors. The bowed grille will be manufactured from mild steel construction with an epoxy coated finish. The assembly of the speaker shall comprise of a
- ii.) 160mm diameter bass/midrange treated coned loudspeaker. It shall have in addition a 25mm Mylar dome tweeter completes with neodymium magnet and a

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factory fitted 6watt / 100volt line transformer. The loudspeaker shall have wide-angle dispersion of 160° and a smooth extended frequency response of

- iii.) 160Hz ~20 kHz. Sensitivity shall be a minimum of 96dB @ 1metre, 1watt test signal bandwidth 100Hz ~10kHz. Transformer shall be 100volt line with 3dB
- iv.) Power taps of 6, 3, 1.5, 0.75 and 0.25watts to be clearly marked on the assembly. The speaker shall be compliant to BS5839 part 8 (Voice Alarm Standard) to include all the above features with the addition of thermal fuse and ceramic terminals to take 2 x2.5mm² cables. Fire Rated cable tail must be fitted for full compliance to BS5839 Part 8. All units to be tested to BS6840 Part 5.
- v.) Approved make: -, Bosch, JBL, BOSE, Ateis (In case OEM does not manufacture speakers they can take Form any of the four approved makes but the speaker selected should be EN 54 -24 / BS 5829 part 8 Compliant. Not CE certifications not allowed

7. ENTERTAINMENT RACK

- i.) The equipment panel shall consist of 1 no. CD player & 1 no.AM/FM tuner. All music transmitted from this position will be routed through the Central Equipment rack to the zone / zones selected though complete windows-based programming.
- ii.) The equipment components shall comply with the following requirements:
FM/AM tuner
The tuner shall contain provision for up to six preset stations, two of which shall be dedicated to MW or LW.
It shall have the following characteristics:
 - iii.) Sensitivity : 3uV for FM channels, 20uV for 26dB SNR for AM section
 - iv.) Distortion : 1% THD IF rejection
: 70db Nominal output
: 100mV Antenna Impedance
: 75 ohms
 - v.) Tuning method : Electronic, onsite adjustable with LED on station Indicator

8. PENDRIVE PLAYER

The player shall be capable of loading into a magazine to provide many hours of repeated play. All discs could be played sequentially or randomly by the use of a remote signal.

- i.) Frequency response : 20 Hz to 20,000 Hz
- ii.) Signal to Noise Ratio : 90dB
- iii.) Distortion : 0.008 % THD @ 1 kHz
- iv.) Channel Separation : 82dB Quantization
: 16-bit twin DAC

9. EQUIPMENT RACK

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- i.) The equipment shall be housed in a standard rack of suitable height, with Plexiglas door or metal mesh and lock. Ventilation panels of 1U height shall be provided between each item of equipment
- ii.) Details of the proposed equipment shall be forwarded to the Consultant with performance specifications, dimensions, construction, and finish for approval.
- iii.) The site shall be fitted with man / machine interface terminal facilities, which shall allow live speech broadcasts to be addressed to selected areas of the site. The unit shall also allow initiation of stored messages and Alarm signals.

10. SPEAKER CABLES

- i.) All cables associated with PA system shall be of following specifications:
- ii.) The 2-core speaker cable will be connected to the speakers by screw terminals before which it shall be
- iii.) Crimped
- iv.) Using 1.5 sq. Mm bootlace lugs. Care has to be taken for avoiding any single strand of wire shall not come out of Lug & screw terminals to avoid noise & leakage.
- v.) Flexible Copper Conductor of cross section 1.5 Sq. mm / 2.5 Sq.mm PVC insulated, PVCFRLS sheathed
- vi.) Control Cable as per IS 694. These Cables shall be laid in G.I. Conduits concealed/surface.

11. APPLICABLE STANDARDS

- i.) BS 5839 part 8: Code of Practice for the design, installation, and servicing of voice alarm systems
- ii.) EN60849: International Standards Sound Systems for Emergency Purposes BS 6259: Reinforcement of Pro-Audio Systems with Voice Evacuation. IEC60268 Part 5: speaker rated power in compliance
- iii.) BS6840 Part 5: Speaker tested in accordance with. UL Listed
- iv.) Speakers EASE, CATT and ULYSSES models for acoustical studies.

APPROVED MAKES-, BOSE/Bosch, ATEIS -PRESIDEO

12. INSTALLATION:

- i.) Installation shall be as shown on the drawings, and as recommended by the major equipment manufacturer.
- ii.) All cables, junction boxes, cables support, and hangers shall be concealed in finished areas and may be exposed in unfinished areas

13. COMMISSIONING:

- a) At final commissioning of each system, the Contractor shall confirm that: All devices, control panels are tested and operate correctly.
- b) The standby batteries are adequately sized. (Measurements of the quiescent and full loads shall be taken and compared to calculated values used at the design stage.) Calculations and measurements shall be submitted to the Engineer.
- c) Commissioning shall be fully documented, and the documentation submitted to the Engineer.
- d) The Contractor shall demonstrate each zone and main panel to the satisfaction of the Engineer by conducting a series of witnessed acceptance tests as directed

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by the Engineer. This shall take place after the above final commissioning and following receipt of the commissioning documentation by the Fire Engineer.

- e) Both the installation and the commissioning activities shall be undertaken as a single continuous operation.
- f) Upon completion of the installation activity, the contractor shall Test, Start-up, Commission and Handover the system to the customer.
- g) The contractor shall make use of the following documents to record test results and details of commissioning tests:
 - i.) Cable Test Sheets
 - ii.) Installation Check Report
 - iii.) System Layout Drawing(s)
 - iv.) System Schematic Diagram(s)

The contractor shall be responsible for inspecting and testing the complete system. The contractor shall present an Acceptance Certificate for signature by the customer.

14. DOCUMENTATION:

The contractor, upon completion of the commissioning activity, shall hand over the system to the customer. At the time of hand over, the contractor shall provide the customer with the following documentation:

- a) Copy of detailed report
- b) Component and equipment list
- c) Product description sheets
- d) System design drawing(s)
- e) System schematic diagram(s)
- f) System operating manuals

15. HANDOVER:

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance Instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s), illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, maintenance operations and procedures shall be included in the manual.

16. TRAINING:

16.1 GENERAL

- a) The contractor shall provide the customer with details of the training required by personnel to operate and maintain the PA system.
- b) The Contractor and the customer shall jointly agree the number of staff to attend the training course

16.2 MAINTENANCE:

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- a) Routine maintenance should be carried out in accordance with relevant customer's requirements (monthly / quarterly / half yearly / yearly). All performance checks undertaken should be recorded in the system logbook.
- b) As a minimum, the following performance checks must be undertaken on each maintenance visit. Carry out verification checks as detailed in the commissioning instructions.
- c) Remove dust and dirt from the Control Panels/speakers using a soft brush or a lint cloth. A solvent which is harmless to the finishes of metal and plastic may be applied to more stubborn stains.
- d) Examine the exterior of the enclosure for any signs of damage or loose cable glands and rectify any faults found.
- e) Examine the printed circuit boards for signs of overheating, dry joints and/or damaged tracks.
- f) Examine the battery terminals for secure connection and for any signs of Corrosion. Replace or repair as required

16.3 SCOPE OF WORK

- a) The contractor shall supply, install, test, connect and commission a high quality fast-acting Public Address and Voice Alarm System and Professional Audio
- b) The Public Address and Voice Evacuation System shall comprise of Audio Matrix Units, High Quality speakers, Power Supplies, Side Lobe Free Line Array DSP "Digital Signal Processor" Speakers, Side Lobe Free Bass Array DSP Speakers, Musical Horn Speakers, Wall Mounted Speakers, Pro-Audio Input Plates, Automatic Gain Control Microphones, Audio rack all mounted on a 19" Rack and fully connected and integrated on the fire alarm loop.
- c) The system shall be Decentralized, each Node shall comprise of Distributed Amplifier Unit "DAU" which shall comprise of all the intelligence including but not limited to Master Control "DSP" with in-built messages, Amplifiers, Power Supplies and Music Routers. All these Nodes "DAUs" shall be on LAN.
- d) There shall be no PC to control or to route instructions to these Nodes on the Network.
- e) The system shall report fault back to all network nodes indicating which segment of the network has been damaged. The Fault report shall be pinpointed out on the Graphical User Interface "GUI" as well.
- f) The system shall be used for Professional Sound Reproduction for all the areas where possible special events take place. It shall be possible to plug-in or inject Music Sources at certain Plates Locations, and from the GUI "Graphical User Interface" shall be able to route the music to any location in the premise.
- g) The Professional Sound System shall comprise state of the Art Side Lobe Free Line Array Systems for the Mid-High frequencies and a accompanied with sate of art Side Lobe Free Bass Array. Both the Speakers shall be DSP "Digital Signal Processing" Active Speakers. These speakers shall provide narrow throw of 5degree vertical and 140-180 degree horizontal.

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- h) Prior to placing order for any equipment, the contractor shall submit comprehensive document comprising working drawings, catalogues and descriptive literature of components, acoustic calculation to meet with BS5839 part 8 RASTI requirements of 0.5 on the STI scale and 0,7 on the CIS scale as per EN60849.
- i) The contractor shall be required to train and instruct client's personnel in the correct use, operation, and supervision of the system, preferably prior to the handing over of the project.
- j) The contractor shall ensure that all system components offered shall be manufactured by a manufacturer with background of min of 15 years with a local India support representation and with a service center in India.
- k) In order to ensure whole site integration capability, the fire and voice alarm system will be awarded to a single specialist local System Integrator who will be responsible for the design, global operation, management and interfacing of the system as defined in BS5839 part 1.
- l) The contractor shall make sure that all power tapping of the speakers must be carried out as specified, even if the acoustic calculations indicate less power tapings.
- m) The background noise of the projects shall be considered 75dBA. The contractor must endure
- n) Minimum of 10dB above noise levels are achieved.
- o) The system shall be fully programmed to accommodate fire alarm and voice communication zones as indicated on the drawings and schematics. The system shall be configured to allow on site modifications with the minimum of disruption using the PC based software to facilitate future changes or alterations to the buildings.
- p) The System shall be capable of identifying the Evacuation Zones via Software, and shall be able to Page, Evacuate, Alert zones as required by the Cause and Effect of the Fire Alarm without any limitation to the number of zones.

16.4 INSTALLATION

- a) Installation shall be as shown on the drawings, and as recommended by the major equipment manufacturer.
- b) All cables, junction boxes, cables support, and hangers shall be concealed in finished areas and may be exposed in unfinished areas

16.5 COMMISSIONING:

- a) At final commissioning of each system, the Contractor shall confirm that all devices, control panels are tested and operate correctly.
- b) The standby batteries are adequately sized. (Measurements of the quiescent and full loads shall be taken and compared to calculated values used at the design stage.) Calculations and measurements shall be submitted to the Engineer.
- c) Commissioning shall be fully documented, and the documentation submitted to the Engineer.
- d) The Contractor shall demonstrate each zone and main panel to the satisfaction of the Engineer by conducting a series of witnessed acceptance tests as directed by the

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Engineer. This shall take place after the above final commissioning and following receipt of the commissioning documentation by the Engineer.

- e) Both the installation and the commissioning activities shall be undertaken as a single continuous operation.
- f) Upon completion of the installation activity, the contractor shall Test, Start-up, Commission and Handover the system to the customer.
- g) The contractor shall make use of the following documents to record test results and details of commissioning tests:
 - i.) Cable Test Sheets
 - ii.) Installation Check Report
 - iii.) System Layout Drawing(s)
 - iv.) System Schematic Diagram(s)

The contractor shall be responsible for inspecting and testing the complete system. The contractor shall present an Acceptance Certificate for signature by the customer.

16.6 DOCUMENTATION:

- a) The contractor, upon completion of the commissioning activity, shall hand over the system to the customer.
- b) At the time of hand over, the contractor shall provide the customer with the following documentation: Copy of detailed report
- c) Component and equipment list Product description sheets System design drawing(s) System schematic diagram(s) System operating manuals

16.7 HANDOVER:

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s), illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, maintenance operations and procedures shall be included in the manual.

16.8 TRAINING:

- a) The contractor shall provide the customer with details of the training required by personnel to operate and maintain the PA system.
- b) The Contractor and the customer shall jointly agree the number of staff to attend the training courses.

16.9 MAINTENANCE:

- a) Routine maintenance should be carried out in accordance with relevant customers' requirements. All performance checks undertaken should be recorded in the system logbook.
- b) As a minimum, the following performance checks must be undertaken on each maintenance visit. Carry out verification checks as detailed in the commissioning instructions.

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- c) Remove dust and dirt from the Control Panels/speakers using a soft brush or a lint cloth. A solvent which is harmless to the finishes of metal and plastic may be applied to more stubborn stains.
- d) Examine the exterior of the enclosure for any signs of damage or loose cable glands and rectify any faults found.

Examine the printed circuit boards for signs of overheating, dry joints and/or damaged tracks. Examine the battery terminals for secure connection and for any signs of corrosion. Replace or repair as required.

**TECHNICAL SPECIFICATIONS FOR WATER BASED FIXED FIREFIGHTING SYSTEM
SUCH AS FIRE PUMPS, HYDRANT SYSTEM, SPRINKLER SYSTEM, WET RISER ETC.**

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1.0 SCOPE

The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of the fire protection system. The philosophy of the system is as follows:

- a) The Fire Suppression System shall comprise the Fire Hydrants System and Hand Appliances.
- b) Water from the overhead tank 1nos RCC Fire Water Storage Tanks, each of 20cum capacity, shall be supplied for the uses listed below.
- c) Fire Hydrant System (Pressurized) for the hydrants and the internal landing valves and the hose reels at landings.
- d) The Hydrant System, under normal conditions, shall be lowest pressurized by means of the electric motor driven Booster pump.
- e) The Hydrant System shall be provided with one electric motor driven pump sets.
- f) The starting and stopping of the Jockey pump shall be automatic based on the pressure switches at pre-set low and high pressure.
- g) The electric motor driven Pump starts automatically at a pre-set pressure by means of a pressure switch. As soon as the Pump starts, the Jockey Pump Stops. If for any reason the electric motor driven Pump does not start at the pre-set pressure or is unable to maintain the pressure, the diesel engine driven Hydrant Pump starts at the pre-set pressure.
- h) The Fire Pump shall be stopped only manually.
- i) Contractor shall ensure Hydro Testing for the complete system.
- j) The Contractor shall obtain the necessary approval of the drawings and the schemes from the local authority / TAC as called for. The contractor shall also take care of any other requirement so that insurance cover can be obtained, if required at minimum premium at a later date.
- k) The contractor shall design and after approval of Project Manager display near each staircase landing at floor levels, a glass covered framed floor plan clearly showing the locations of all landing valves, hose reels, hand appliances, as well as the DO's and DON'T's for the personnel and the exit direction in case of an emergency. The dimensions of the floor plan, its scale, lettering size, color scheme etc shall be as directed by the Project Manager.

2.0 Pipe Work

2.1 General Requirements

- a) All materials shall be of the best quality conforming to the specifications and subject to the approval of the Fire Officer/Consultants.
- b) 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.

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- c) Pipes shall be securely fixed to walls and ceilings by suitable clamps and supports (galvanized after fabrication) at intervals specified. Only approved type of anchor fasteners shall be used for RCC slabs and walls / floors etc.
- d) Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.
- e) Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.
- f) Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable/ recognized authority.

2.2 Piping

- a) The general specification of piping shall be as per 'CPWD General Specifications for Electrical works Part V (Wet Riser & Sprinkler System)' for detailed specifications for piping works 'Chapter 7 Pipe Works'. Pipes of following types are to be used:
- b) Mild steel black/GI pipes heavy grade (for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall also be suitably being lagged with 2 layers of 400-micron polythene sheet over 2 coats of bitumen.
- c) Steel pipelines up to 150 mm dia, shall be as per IS: 1239, Part-II (heavy grade) while pipelines above 150mmdia.shall be as per IS: 3589.
- d) All pipe clamps and supports shall be fabricated from MS steel sections and shall be factory galvanized before use at site. Welding of galvanized clamps and supports shall not be permitted.
- e) Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered.
- f) Hangers and supports shall be thoroughly galvanized after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor braces, dampener, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultants/Fire Officer.

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- g) The piping system shall be tested for leakages at 2 times the operating pressure or 1.5 time shut-off pressure, whichever is highest including testing for water hammer effects.
- h) Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.
- i) For pipes underground installation the pipes shall be buried at least one meter below ground level and shall have 230mm x 230mm masonry or concrete supports at least 300mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand: 8 stone aggregate) of size 380x380x75 thick resting on firm soil.
- j) Mains below ground level shall be supported at regular intervals not exceeding 3.0meters and shall be laid at least 2.0meter away from the building.

2.2.1 Piping Installation & support

- a) Refer 'CPWD General Specifications for Electrical works Part V (Wet Riser & Sprinkler System)' for detailed specifications for piping works 'Chapter 7 Pipe Works'.
- b) Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.
- c) Piping shall be properly supported on, or suspended from, on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps, and hangers, and be responsible for their structural stability.
- d) Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. Risers shall be supported at each floor with Galvanized steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanized steel sections.

Pipe hangers shall be provided at the following maximum spacing's:

| Pipe Dia (mm) | Hanger Rod Dia (mm) | Spacing between Supports (m) |
|----------------------|----------------------------|-------------------------------------|
| Up to 25 | 6 | 2 |
| 32 to 50 | 6 | 2.5 |
| 65 to 80 | 8 | 2.5 |
| 80 to 100 | 10 | 2.5 |
| 125 to 150 | 10 | 3.0 |
| 200 to 300 | 12 | 3.5 |

- e) The end of the steel rods shall be threaded and not welded to the threaded bolt.

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- f) All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.
- g) Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.
- h) Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fibre glass and finished with retainer rings.
- i) The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.
- j) All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.
- k) Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 25mm pipe size and shall be associated with an equal size Isolation valve. Discharge from the air valves shall be piped through a pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.
- l) Pressure gauges shall be provided as shown on the approved drawings. Care shall be taken to protect pressure gauges during pressure testing.

2.2.2 Pipe Fittings

- a) The general specification of pipe fittings shall be as per 'CPWD General Specifications for Electrical works Part V (Wet Riser & Sprinkler System)' for detailed specifications for piping works "Chapter 7 Pipe Works".
- b) Pipe fittings mean tees, elbows, couplings, unions, flanges, reducers etc and all such connecting devices that are needed to complete the piping work in its totality.
- c) Ductile Iron / Cast Iron / Forged steel screwed type fitting shall be used for pipes of 50 mm dia. & below. Fabricated fittings shall not be permitted for pipes diameters 50mm and below.
- d) Fabricated fittings used on pipe size 65 mm & above shall be fabricated, welded in workshops. They shall be inspected by Project Manager before dispatch from the

workshop. The welding procedures of the workshop should have been approved by the rules for sprinkler system and applicable to hydrant and sprinkler system. For “T” connection, pipes shall be drilled and reamed. Cutting by gas or electrical welding shall not be permitted.

2.2.3 Procedure for Pypkote /Coatek Application

- a) Surface Preparation - The pipe surface shall be cleaned by a wire brush.
- b) Application of Primer - Pypkote/Coatek primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.
- c) Application of Pypkote/Coatek4mm Tape - After the primer is applied on the pipe, it is allowed to dry for about
- d) 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape
- e) & pipe is obtained. Overlaps are maintained with a minimum of 12.5mm.
- f) Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm.
- g) A final coat of Whitewash with water-based cement paint is done immediately over the entire coated pipe.

2.3 Jointing

2.3.1 Welded Joints

- a) Joints between pipes and fittings shall be made with the pipes and fittings having “V” groove and welded with electrical resistance welding in an approved manner. But welding without “V” groove shall not be permitted.
- b) All joints in the pipeline with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer.
- c) Flanged joints (65mmdia. and above)
- d) Flanged joints with flanges conforming to IS: 6392 shall be provided on
- e) Straight runs at intervals not exceeding 25-30m on pipelines of 50mmdia. and above and as directed by the Project Manager.
- f) For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.
- g) Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

2.3.2 Unions (up to 50mm dia.)

Approved type of dismountable unions shall be provided on pipelines of 40mmdia and smaller dia., in locations similar to those specified for flanges.

2.4 System Drainage

The system shall be provided with suitable drainage arrangement with drain valves complete with all accessories.

3. Valves

The general specification of Valves shall be as per 'CPWD General Specifications for Electrical works Part V (Wet Riser & Sprinkler System)' for detailed specifications for piping works "Chapter 7 Pipe Works'.

3.1 Gate Valves

- a) Gates valves used in high pressure (head) piping shall be made of forged Brass and of suitable class as indicated in specifications, drawings & schematics or higher if required.
- b) Supplying, fixing and testing shall correspond to IS: 778-1984.
- c) Valves shall be tagged with permanent label under hand wheel indicating type or duty.
- d) All valves shall have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same. Gate valve handle shall be in steel.
- e) Gate valves shall be of the size as specified in the BOQ.

3.2 Butterfly Valve

- a) The butterfly valve shall be suitable for waterworks and rated for 250 P.S.I
- b) The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the water pressure. The disc shall be heavy duty cast iron with anti-corrosive epoxy or nickel coating.
- c) The valve seat shall be of high-grade elastomers or nitrile rubber. The valve is closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomers rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be EN 8 grade carbon steel.

- d) The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

3.3 Ball Valve

- a) The ball valve shall be made forged brass and suitable for test pressure of pipe-line. The valve shall be internally threaded to receive pipe connections.
- b) The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.
- c) The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' Situations. The gap between the ball and the Teflon packing shall be sealed to prevent water seeping.
- d) The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

3.4 Check Valves (Non-Return Valves):

- a) Flap type non return valve Valves (Horizontal type) and above shall be Cast iron Double flanged type with. b) Non-Return Valves in exposed locations e.g., pump house etc. shall be provided.
- b) Valves on G.I. Pipes 50 mm and below shall be Brass valves. d) Valves shall conform to and marked IS: 778.
- c) Valves shall be measured by numbers and shall include matching flanges, rubber gaskets, bolts, nuts, washers, and all items necessary and required and as given in the specifications to complete the work to the satisfaction of Owner/ Architect/ Employer's Representative.

3.5 "Y"-Strainers

- a) Strainers shall be preferably of the approved 'Y' type with C.I. construction and of suitable class as indicated in drawings and schematics or higher as required.
- b) Strainers shall incorporate removable stainless steel with 3.175 mm (1/8") or minimum diameter perforations and a permanent magnet.
- c) Strainers shall be provided with flanges.
- d) Strainers shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of all screens without disconnection of the main pipe.
- e) The pocket should point vertically downwards; this ensures that the removed debris is not drawn back into the upstream pipe work during low flow conditions.
- f) Although it is advisable to install strainers in horizontal lines, this is not always possible, and they can be installed in vertical pipelines if the flow is downwards, in which case the debris is naturally direct ending to the pocket.

- g) If the end connections are threaded or designed for soldering and brazing, the pipes shall be straight and not at an angle or offset.
- h) If the end connections are flanged care shall be taken that the flanges of the connecting pipes are square with the pipe so that no undue stresses are put on the strainer or piping while tightening the bolts.

3.6 Shank Reducers

- a) Shank reducer (Male type) 63 mm dia SS-304 for connection purpose of HOSE REEL HOSE
- b) The shank reducer shall be connected with the Hose pipe
- c) The hose pipe shall be double braided Type 2.
- d) When tested in accordance with the standards the pipe shall show no leakage, rupture at the proof pressure.

3.7 Pressure Relief Valve

Each System shall be provided with a Pressure Relief Valves. The Valve shall be spring actuated and set to operate as per field requirement. The Valve shall be constructed of bronze and provided with an open discharge orifice for releasing the water. The Valve shall be open lift type.

3.8 Pressure Switch

- a) The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. The housing shall be die cast aluminium, with SS 316 movement, pressure element and socket. The set pressure shall be adjustable.
- b) The Switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP: 55 water and environment protection.

3.9 Pressure Gauge

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 50mmdia., Gunmetal bourdon type gel filled with gunmetal isolation ball valve, tapping, and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

3.10 Painting

- a) All Hydrant pipes shall be painted with post office red color paint. All pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc.
- b) Painting shall be expertly applied; the paint shall not over run-on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

4 HYDRANTSSYSTEM

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4.1 MATERIAL

4.1.1 Internal Hydrants

- a) Contractor shall provide on each floor, internal hydrants consisting of one no. Stainless steel fire hydrant double landing valve with 63 mm dia. outlets and 100 mm inlet conforming to and marked IS:5290 (Type 'B') with Cast Iron Wheels.
- b) Landing Valves shall have flanged inlet and instantaneous female type outlets.
- c) Instantaneous outlets for Fire Hydrants shall be of standard approved pattern and suitable for Fire Brigade hose of 63 mm with couplings conforming to and marked IS: 903. Alongside each hydrant, there shall be a hose box to accommodate two numbers of IS 636 hose, each of 15 m length.
- d) Contractor shall install orifice plate flanges on all hydrants having excessive pressure more than 3.5 bars, Orifice plates shall be fabricated from 6 mm stainless steel plates with plain central hole without burrs.
- e) The bore of the orifice shall be designed by the Contractor and calculations to be submitted to Owner/ Architect/ Consultants/ Employer's Representative for approval.
- f) Branch pipes shall be gunmetal type of 63 mm dia. with nozzle of 20 mm dia. as per IS 903.
- g) Hose cabinet shall be of glass fronted with hinged door & lock. The cabinet shall be made of 16 gauge thick
- h) MS sheet and spray painted to shade No. 536 of IS:5.
- i) Hose cabinets shall be SS 304 with hinged door.
- j) The hose cabinet shall be of size to accommodate the following:
 - i) Landing Valves (Single/double headed)
 - ii) Canvas Hose pipe
 - iii) Hose reel (30 mtr)
 - iv) Branch pipes, nozzles (2 sets)
 - v) Orifice Plate.
 - vi) Fire man's axe and hand appliances

4.1.2 External Hydrants

- a) External Hydrants (Yard Hydrants) shall conform to and marked IS:5290 (Type 'A'). External hydrants shall consist of a stand post 80mm NB, duck foot bend, a single headed oblique pattern hydrant valve of 63mm NB, instantaneous female type coupling, gun metal cap and chain.
- b) Alongside each hydrant, there shall be a hose box to accommodate two numbers of non-percolating rubber
- c) reinforced line fire hose pipe (IS: 636) each of 63mm dia. and 2 Nos. of 15 M long conforming to IS: 8423 complete with instantaneous ISI marked Gun-Metal Male & External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar,

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Female couplings (IS: 903) and 1 No. 63mm dia. ISI marked Gun-Metal Short Branch Pipe with nozzle (IS:903).

- d) Contractor shall install orifice plate flanges on all hydrants having excessive pressure (more than 3.5 bar),
- e) Orifice plates shall be fabricated from 6 mm thick stainless-steel plates with plain central hole without burrs.
- f) The bore of the orifice shall be designed by the Contractor and calculations to be submitted to Owner/
- g) Architect/Consultants/ Employer's Representative for approval.
- h) The hose cabinet shall be of size to accommodate the following:
 - i) Single/Double headed yard hydrant valve
 - ii) Hose pipe (2 length of 15 m)
 - iii) Branch pipes, nozzles (2 sets)
 - iv) Fire man's axe

4.1.3 First Aid Hose Reels

- a) Contractor shall provide standard First-aid Hose Reel with 20 mm dia. high pressure braided rubber hose propose pump room for the same from your end and send us.30 M long with gunmetal adjustable jet spray nozzle and manual operating valve, all mounted on circular hose reel of heavy mild steel construction with Cast Iron Bracket having a swivel hinge.
- b) Hose reel drum shall strictly conform to IS: IS: 884-1985. A lock shield type isolating valve shall be installed on the fire hose reel supply piping adjacent to each hose reel.

4.1.4 Branch Pipe, Nozzle

- a) Branch pipes shall be of gun metal with loaded tin bronze ring at the discharge and to receive the nozzle and provided at the other with a leaded tin bronze ring to fit into the instantaneous coupling.
- b) Nozzle shall be of spray type of diameter of not less than 16 mm and not more than 25 mm.
- c) Nozzle shall be of loaded tin bronze branch pipe and nozzle shall be of instantaneous pattern conforming to Indian Standard - 903.

4.1.5 Fire Hose Cabinets (FHC) Concealed type

- a) Cabinets shall be concealed type made of masonry construction, sized to accommodate Double landing valve(s), 15m long hoses, first-aid hose reel, branch pipe nozzle, fire man axe and fire accessories.
- b) All fire cabinets shall be painted 'Fire Red' from outside. The inside of the cabinet shall be white baked enamel.

- c) Hose cabinets shall have glass front door with 4 mm thick clear glass and powder coating `Red` finish Outside and `White` inside. There shall be breakable glass type feature to keep key.
- d) Fire shaft shall have doors fabricated by M.S. sheet of 16 SWG with glass-fronted door (glass shall be 4mm thick) and size of the shutter shall be 1500mm x 900mm minimum.
- e) Door shall be in two leaves with necessary stiffeners. Door shall be powder coated finish of `Red` outside and `White` inside and on the glass label of "FIRE" shall be stuck. The letter size shall be min. 75 mm height. There shall be built in breakable glass type feature to keep key.

4.1.6 Fire Hose Pipe (FHP)

Rubber reinforced lined fire hose pipe (as per IS: 636) of 63mm dia. and length as described in BOQ.

- a) The Fire Hose Pipe shall be rated for burst pressure of 37.5 kg/sq cm. Hose shall be complete with ISI marked brass male and female coupling (IS:903) bound and riveted to hose pipe with copper rivets and 1.5mm copper wire

4.1.7 Drain Valves

Contractor shall provide G.I. Pipe as per IS:1239 heavy class with necessary gate / ball valve for draining water in the system as indicated in the drawing.

4.1.8 Air Vessel

- a) The air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter-acting pressure, surges, whenever the pumping sets come into operation.
- b) Air vessel plates shall conform to IS: 2002:2009.
- c) It shall be normally half full of water when the system is in normal operation.
- d) Air vessel shall be fabricated with 8 mm thick M.S. plate with dished ends and suitable supporting legs.
- e) It shall be provided with one 100 mm dia. flanged connection from pump, one 25 mm drain with valve, one water level gauge and 25 mm sockets for pressure switches.
- f) The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5times the shut-off.

4.1.9 Auto Air Vent

Brass material Automatic air release valve with stop cock screwed inlet connection and drain arrangement with 25mm diameter shall be provided on every hydrant, sprinkler and wet risers to be risers at topmost point.

4.1.10 Orifice Plates

- a) The orifice plate designed as per ISO5167 or Equivalent Standard is supplied along with a set off flanges, gaskets, studs, nuts & plugs. Two pairs of flange tapings are generally ½" NPT (F). The flanges are to be welded in the pipeline with sufficient upstream and downstream lengths and properly bolted.

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- b) The Diameter of such orifice shall not be less than 50% of the dia. of pipe into which it is to be fitted, which shall not be less than 50mm dia.
- c) These orifice plates must be of stainless steel with plain central hole without burrs, and the thickness shall
- d) be 3mm for pipe size up to 80 mm, 6 mm for pipes from 80 to 125 mm dia. and 9mm for pipes greater than
- e) 125 mm dia.
- f) For restricting pressure in the sprinkler system, orifice plates of appropriate sizes shall be fitted at different floor levels, at the branching points from Riser Main.
- g) Such orifice plate must have a projecting identification tag.
- h) The orifice plate shall fit at a distance of not less than two pipe internal diameters downstream of the outlet from any elbow or bend.
- i) Contractor shall submit the design for engineer's approval and identify location on drawing before installation.

4.1.11 Fire Brigade Connections

- a) Fire brigade connection shall be as per IS: 5131.
- b) Contractor shall provide four numbers of 63mm NB gunmetal Fire Brigade type instantaneous inlets with built in check valves and 150 mm dia. flanged outlet connection with butterfly.
- c) The collecting heads shall be connected to fire water tank for the use of local Fire Brigade. Fire brigade connection shall be enclosed in a suitably sized glass fronted box mounted at a suitable position.
- d) It shall be connected to the storage tank with a 150 mm fire brigade pumping connection to discharge at least 2275 litres/ minute into it.
- e) This connection shall not be taken directly into the side of the storage tank but arranged to discharge not less than 150 mm above the top edge of the tank such that the water flow can be seen.
- f) The connection shall be fitted with stop valve in a position approved by the Employer's Representative. An overflow connection discharging to a drain point shall be provided from the storage tank.
- g) The fire brigade connection shall be located as to make the inlets accessible from the outside of the building.
- h) The size of the wall box kept beside the inlet shall be adequate to allow hose to be connected to the inlets, even if the door cannot be opened and the glass has to be broken.
- i) Each box shall have fall of 25mm towards the front at its base and shall be glassed with wired glass with " FIRE BRIGADE INLET" painted on the inner face of the glass in 50 mm size block letter.

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- j) Each such box shall be provided with a steel hammer with chain for breaking the glass.
- k) In addition to the emergency fire brigade connection to the hydrant main, a 150mm common connection shall be taken from the two 63mm instantaneous inlets direct to hydrant main so that the fire brigade may pump to the hydrants in the event of the hydrant pumps being out of commission.
- l) The connection shall be fitted with a sluice valve and reflux valve. Location of these valves shall be as per the approval of the Employer's Representative.

4.2 Execution

4.2.1 Scope

Scope of work under this section comprises of furnishing all equipment, appliances, materials, labour necessary and required to install/ modify Wet Riser Fire Hydrant System / Components as required by the drawings, specified herein or given in the bill of quantities.

4.2.2 General

Without restricting to the generality of the foregoing the Fire Hydrant System shall include the following: -

- a) Galvanized iron, Class C (heavy) (wrapped and coated for underground piping) mains including valves, fittings, grooved, yard hydrants and appurtenances, as specified.
- b) Galvanized iron, Class C (heavy) pipe mains/risers internal exposed including valves, fittings, flanges and appurtenances, as specified.
- c) Landing valves, hose reels, hose cabinets, hose pipes, orifice plate, branch pipes. d) Fire brigade connection and connections to pumps and appliances.
- d) Fire Pumps, Jockey Pump, Electric Motors, Diesel Engine Pumps, Booster Pumps Control Panels, Valves, Air Vessels, Cabling, and accessories, as specified.
- e) All materials shall be conforming to specifications and subject to the approval of the Architect/Employer's Representative Fire Officer.
- f) Pipe and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat work like Manner.
- g) 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.
- h) Pipes shall be securely fixed to Brick/RCC walls and ceilings by suitable clamps / hangers /sleeves/ Brackets at intervals specified. Only approved type of anchor fasteners shall be used.
- i) Valves and other appurtenances shall be so located that they are easily accessible for operations repairs and maintenance.
- j) Construction of fire water tanks are not part of this package.
- k) No jute will be allowed in threaded joints.
- l) If header piping is less than 50mm then shoe joints is to be provided.

4.2.3 Installation of Orifice Plate

- a) Determine the location & orientation. Sufficient upstream and downstream straight length of pipe must be kept without any restriction like valves, bypass arrangement, thermo – well pockets etc. To get a fully developed flow profile this helps in obtaining the published accuracy per standard.
- b) Depressurize the line using site – specific requirements.
- c) Loosen all studs and nuts. Remove the studs in one – half of the flange union and spread flange union by turning jackscrews clockwise.
- d) Install the Orifice plate with the face marked “INLET” on the tag towards upstream.
- e) The orifice plate must be installed concentric with the pipe ID.
- f) Install the new gaskets when installing the plate. It is recommended that new gaskets be installed each time the orifice flange union is separated.
- g) Release the flange union by turning the jack screws counterclockwise.
- h) Replace the studs & tighten nuts in a star pattern.
- i) One pair of tapping must be plugged or closed with an isolation valve. j) Such orifice plate must have a projecting identification tag.
- j) The orifice plate shall fit not less than two pipe internal diameters downstream of the outlet from any
- k) elbow or brand.
- l) Contractor shall submit the design for engineer’s approval and identify location on drawing before installation.

4.3 Testing and Commissioning

4.3.1 Fire Hydrant System

- a) Pressurize the fire hydrant system by running the jockey pump and after it attains the shut off pressure of the pump.
- b) 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 pressure. If necessary, adjust the pressure switch for the jockey pump. Close by-pass valve.
- c) 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 shall cut-in at the pre-set pressure and shall not cut-out automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However, the jockey pump shall cut-out as soon as the main pump starts
- d) Switch off the main fire pump and tests check the standby pump in the same manner as the electrically driven pump.
- e) 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.
- f) Check each landing valve, male and female couplings, and branch pipes, for compatibility with each other.

- g) Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.

5 SPRINKLER SYSTEM

5.1 Material

- a) The entire sprinkler installation shall be designed to make it a hydraulically balanced system. The pressure requirement at all floors shall be designed for 0.5 to 1.5 bar at each sprinkler outlet and as per the material approves.
- b) Pipe's fittings and support shall be the same as for Fire Hydrant System.
- c) Jointing shall be the same as for Fire Hydrant System. All risers shall be installed with Grooved flexible coupling fittings.
- d) Valves shall be the same as for Fire Hydrant System. Orifice shall be the same as for Fire Hydrant System.

5.2 Test Connection

Contractor shall provide 15 mm dia. Gun-Metal Globe Valve / Gate Valve along with flow meter and pressure gauge with MS Pipe as specified earlier for testing and draining any water in the system in low pockets wherever required. This item shall be measured similar to the normal piping system.

5.3 Sprinkler Heads

5.3.1 Material Details

| Sprinkler Temperature Classification | Sprinkler Nominal Temperature rating | Maximum Ambient Ceiling Temperature | Bulb |
|---|---|--|-------------|
| Ordinary | 155 Deg F (68 Deg C) | 100Deg F (38DegC) | Red |
| Kitchen | 285.8 Deg F (141 Deg C) | | Blue |

- a) Sprinkler heads shall be of brass quartzoid bulb type containing liquid having high vapour pressure held in position by forged GM yoke and deflector.
- b) Spacing's shall be in conformity with the drawings and properly co-coordinated with electrical fixtures and air-conditioning ducts, diffusers and grills and other ceiling services.
- c) Detailed shop drawings for sprinkler system shall be prepared by Contractor and submitted to Owner/ Architect/ Consultants /Employer's Representative for approval before starting the work. d) Temperature rating of sprinkler heads shall be as per above mentioned in BOQ.
- d) The inlet shall be screwed for 15mm dia. as specified. The sprinkler head shall have UL/ FM approval or listing.

e) Sprinkler shall be quick response type for all areas except car park and mechanical areas.

f) Contractor shall supply 2% spare sprinkler heads and one spanner (not separately payable), neatly installed in a wooden cabinet with glass shutters as approved by the Employer's Representative.

Table 6.2.3.1 Sprinkler Discharge Characteristics Identification

| Nominal K-Factor [gpm/(psi) ^{1/2}] | Nominal K-Factor [L/min/(bar) ^{1/2}] | K-Factor Range [gpm/(psi) ^{1/2}] | K-Factor Range [L/min/(bar) ^{1/2}] | Percent of Nominal K-5.6 Discharge | Thread Type |
|---|---|---|---|--|------------------------------|
| 1.4 | 20 | 1.3-1.5 | 19-22 | 25 | ½ in. NPT |
| 1.9 | 27 | 1.8-2.0 | 26-29 | 33.3 | ½ in. NPT |
| 2.8 | 40 | 2.6-2.9 | 38-42 | 50 | ½ in. NPT |
| 4.2 | 57 | 4.0-4.4 | 59-64 | 75 | ½ in. NPT |
| 5.6 | 80 | 5.3-5.8 | 76-84 | 100 | ½ in. NPT |
| 8.0 | 115 | 7.4-8.2 | 107-118 | 140 | ¾ in. NPT or ½ in. NPT |
| 11.2 | 160 | 10.7-11.7 | 159-166 | 200 | ½ in. NPT or ¾ in. NPT |
| 14.0 | 200 | 13.5-14.5 | 195-209 | 250 | ¾ in. NPT |
| 16.8 | 240 | 16.0-17.6 | 231-254 | 300 | ¾ in. NPT |
| 19.6 | 280 | 18.6-20.6 | 272-301 | 350 | 1 in. NPT |
| 22.4 | 320 | 21.3-23.5 | 311-343 | 400 | 1 in. NPT |
| 25.2 | 360 | 23.9-26.5 | 349-387 | 450 | 1 in. NPT |
| 28.0 | 400 | 26.6-29.4 | 389-430 | 500 | 1 in. NPT |

g) Refer Sprinkler Discharge coefficient as per following table.

Deviations from the standard or any alternation to the sprinklers or cover plate assemblies before the item reaches on site, may renders the sprinklers inoperative and will automatically nullify approval on site.

5.3.2 Installation details

Before installation, the correct sprinkler, with correct K factor, temperature rating and response Characteristics shall be checked.

- a) For flush and concealed type sprinklers: Cut the sprinkler nipple so that 15-, or 20-mm NPT outlet of the reducing coupling is at the desired location and centred in the opening in the ceiling or wall.
- b) Install not more than one half the sprinkler spacing not less than 102 mm from walls obstructions.
- c) A small amount of pipe joint compound or tape to the external thread of the sprinkler only. Sprinklers with protective caps or bulb shields must be contained within caps or shields before applying any pipe compound or tape.
- d) After installation the sprinkler shall be tested as per the applicable standards
- e) Remove the plastic cap or bulb shields after the wall or ceiling finish work is completed where the sprinkler is installed and there is no longer is a potential for mechanical damage to the sprinkler operating elements.

- f) Remove the cover plate assembly from the protective box, taking care not to damage the assembly.
- g) From below the ceiling, gently place the base of the cover plate assembly over the sprinkler protruding through the opening in the ceiling or wall.
- h) Carefully push the cover plate assembly onto the sprinkler, using even pressure with the palm of the hand, until the unfinished brass flange of the cover plate base touches the ceiling or wall.

5.4 Installation Control Valve

- a) Installation Control Valve for sprinkler system shall consist of a vertical alarm valve complete with 50mm dia. drain and 15mm test valve with a provision to install water operated turbine alarm.
- b) A Cast Iron Butterfly Valves shall be provided on upstream of alarm valve.
- c) The Butterfly Valve shall be strictly as mentioned above. The size of alarm valve and butterfly valve shall be as indicated in BOQ, drawings.
- d) One water operated turbine alarm motor with gong shall be provided for each sprinkler installation control valve on the sprinkler main.
- e) The alarm shall operate and sound a gong on the drop of pressure and flow of water in the mains.
- f) Turbine alarm shall be approved by the Employer's Representative and installed at approved locations. The alarm shall be provided with suitable test cock. Both alarm valve and turbine alarm must have UL/FM approval/ listing.
- g) Installation control valve shall be measured by numbers and shall include upstream C.I. Butterfly Valve, Alarm Valve, Alarm Motor and Gong, Drain Valve, Test Valve, Drain Piping and all fittings including 2 Nos. pressure gauges required to complete the work.
- h) Please refer the scheme as description sheet, BOQ, for the pressure rating.

5.5 Inspection and Test Valve Assembly

- a) Inspection and testing of the automatic starting of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve and orifice assembly as per approved drawing.
- b) Flow Switch
- c) Vane type water flow detectors shall be installed on system piping as designed on drawing / or as specified herein.
- d) Detectors shall mount on any clear pipe span of the appropriate nominal size, either vertical up flow or horizontal run, at least 6" from any fitting which may change water direction, flow rate or pipe diameter or no closer than 24" from valve or drain.
- e) Detectors shall have sensitivity in the range of 4 to 10 gallons per minute & static pressure rating of 20 bars for 2" to 8" pipes.
- f) Detector shall respond to water flow in the specified direction after a present time delay which is field adjustable.

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- g) The delay mechanism shall be sealed mechanical pneumatic unit with visual indication of actuation.
- h) The actuation mechanism shall include a polythene vane inserted through a hole in the pipe & connected by mechanical linkage to the delay mechanism.
- i) Output shall consist of dual SPDT switches (Form C contacts).
- j) Two conduit entrances for standard fitting of commonly used electrical conduit shall be provided on the detectors.
- k) A grounding provision is provided. Unless noted enclosures shall be NEMA 4 listed by Underwriters
- l) Laboratories Inc. for Indoor or outdoor use.

5.6 Alarm valve

- a) Alarm Valve is a double seated clapper check valve with grooved seat design, which ensures positive water flow for alarm operation and is designed for installation in wet pipe sprinkler system.
- b) External bypass prevents false alarm under all supply pressure condition. In the event of variable pressure condition, false alarms are prevented with the provision of retard chamber, thus the design allows for installation under both variable and constant supply pressure condition.
- c) The valve shall have Housing of Cast Iron, Seat of Bronze, Clapper of Bronze, Seat of Neoprene rubber.
- d) Following specification is expected:
 - i.) Maximum service pressure: To suit the system working pressure.
 - ii.) Threaded opening: NPT
 - iii.) Mounting: vertical
 - iv.) Flange connection: IS: 1538 to withstand the system pressure and pressure tests
 - v.) Factory hydrostatic test pressure: 1.5 times the system working pressure.
 - vi.) PN rating shall be as per the schematic, system pressure etc.

5.7 Pipes for Drainage:

- a) Sprinkler pipes shall be so installed that the system can be thoroughly drained. As far as possible all pipes shall be arranged to drain to the installation drain valve as shown in the drawing for ordinary hazard system.
- b) In the case of basement & other areas where sprinkler pipework is below the installation drain valve & in other trapped points in the system, Gate valves of the 25 mm dia shall be provided.

5.8 Execution

5.8.1 Scope

Scope of work under this section comprises of furnishing all equipment, appliances, material, and labour necessary and required to install Automatic Sprinkler System as required by the drawings, specified herein or as given in the bill of quantities.

5.8.2 General

Without restricting to the generality of foregoing, the sprinkler system shall include the following:

- a) Galvanized iron Class C (heavy class) main sprinkler distribution piping complete with welded, forged steel fittings, grooved, flanges, supports, hangers all required accessories and appurtenances.
- b) Installation control valves drain valve, test valve and all connecting pipes and fittings.
- c) Sprinkler heads, nozzles, and spare sprinklers.
- d) Connections to risers, pumps, and appliances.
- e) Sprinklers Pump, Jockey Pump, Booster pump Motors, Control Panels, Air Vessels, Cabling, Instruments, and accessories, as specified.
- f) Sprinkler Lines for each floor shall be left with complete sprinkler drain arrangement with blanked flange.
- g) No jute will be allowed in threaded joints.
- h) Header piping if less than 50mm then shoe joints are to be provided.

5.9 Testing and Commissioning

- a) Start the sprinkler pump and develop the required pressure in the sprinkler pipes.
- b) Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch.
- c) The sprinkler water gong alarm shall also operate when the test valve is open.
- d) This operation is to be done for each and every section of the sprinkler system and the alarm for each section (via flow switch) shall be checked for operation.
- e) After satisfactory operation of the pump the Contractor shall set up mock fire and test the system.

6. FIRE PUMPS & ANCILLARIES

6.1 Material

6.1.1 Scope

Scope of work under this section comprises of furnishing all equipment, appliance, material, labour necessary and required to completely install electrically operated centrifugal pumping sets and a diesel engine driven pump set for Fire Hydrant and Sprinkler installation as required by the drawings and specified hereinafter or given in the bill of quantities. Without restricting to the generality of the foregoing the pumps and ancillary equipments shall include the following:

- a) Electrically operated vertical turbine centrifugal pumps/ main fire pumps, Sprinkler, jockey and booster pumps with motor, base frames, flexible couplings and all accessories as specified.
- b) Installation control valve
- c) Air separators/ Air release valve

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- d) Pressure switches, pressure gauges, pump control valves, test valves, drains, exhausts air vessels etc.
- e) Electrical control panel with necessary logic built in, all cabling, wiring, and annunciation system, earthing etc.
- f) Automatic starting system with all accessories, wiring and connections and pressure switches.
- g) Motor control centre.
- h) Pressure gauges with isolation valves and piping bleed and block valves.
- i) Valves, N.R.V and accessories.
- j) Flexible connections
- k) Vibration eliminator pads and foundation bolts.
- l) Leak-off shall be led to the nearest floor drain.
- m) Eccentric reducer
- n) Pressure relief valve

6.1.2 General Requirements

- a) All pumps shall be installed true to level on suitable concrete foundations. Base frames shall rest on vibration isolation mountings as specified, to avoid vibrations.
- b) Pumps and motors /diesel engine shall be truly aligned to the satisfaction of Owner/Architect/Employer's Representative Fire Officer.
- c) All pump connections shall be of Indian Standard flange type with appropriate number of bolts. Manufacturers' instructions regarding installation, connections and commissioning shall be followed with respect to all pumps, switch-gears, and other accessories.
- d) Pumps shall be designed for continuous operation and shall have a continuously dropping head characteristic without any zone of instability. Power capacity characteristic shall be no over loading type. Head vs. capacity, input power vs. capacity characteristics, etc., shall match to ensure load sharing and trouble-free operation throughout the range. In case of accidental reverse flow through the pump the driver shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed. Contractor under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.
- e) Automatic air release valve shall be provided to vent air from the pump discharge and also to admit to the pump to dissipate the vacuum there, upon stopping of the pump.
- f) Pump coupled with motor or engine on a common base plate shall perform smoothly without any excessive noise or vibration. Also, pump shall be provided with re-circulation piping with valves.
- g) All pumps shall have the impeller size chosen to maximum of 80% of the largest size that can be accommodated in the casing.

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- h) The following inter-locking between the two main fire pumps (i.e., wet riser pump & sprinkler pump), the jockey pump and the diesel engine driven pump. Only one category of pumps will work at a time i.e., either jockey pump or main fire pumps (wet riser and sprinkler, both the wet riser and sprinkler can come up at a time) or diesel driven pump.
- i) Pump shall be capable of delivering 150% of the rated capacity at 65% of the rated head and the no-delivery head shall be not more than 140% (150% in case of end suction type) of the rated delivery head. The pump casing shall withstand 1.5 times the no-delivery pressure or 2 times of the duty pressure whichever is higher.
- j) One solid state electronic annunciation panel fully wired with visual display and audible alarm unit shall be provided to indicate:
 - i.) Flow condition in any flow switch indicating the area of distress and fire alarm.
 - ii.) Starting and stopping of each hydrant pump.
 - iii.) Starting and stopping of each jockey pump.
 - iv.) Starting and stopping of each sprinkler pump.
 - v.) Failure of Hydrant / Sprinkler pumps to start.
 - vi.) High level in Fire water storage tank compartment.
 - vii.) Low level in fire water storage tank compartment.
- k) The panel shall be factory fabricated, wired and tested. All details shall be submitted with the tender. The annunciation panel shall be located in the security office / reception on the ground floor.

6.1.3 Fire Pumping Sets

A. Supplying, installation, testing and commissioning of Diesel Engine Driven Main Fire Pump suitable for automatic operation and consisting of following, complete in all respects, as required: (Diesel Driven Pump -2280LPM with 88-meter head, minimum 77 BHP, 2300 RPM and as to give a minimum 3.5kgf/cm² pressure at the highest/farthest point.)

- a. Horizontal type, multistage, centrifugal Split Casing back pull-out type pump of cast of iron body and bronze impeller with stainless steel shaft, mechanical seal conforming to IS 1520.
- b. Suitable HP, 1500 RPM water cooled with radiator, diesel engine conforming to relevant IS standard complete with auto starting mechanism, 12/24 volts electric starting equipment, diesel tank, exhaust pipe extended up to 10 m outside pump house duly insulated with 50 mm thick glass wool with 1.0 mm thick aluminium sheet cladding, residential silencer, instruments and protection as per standard specification, stop solenoid for auto stop in the event of fault with audio indications, painted with post office red colour etc. as required.
- c. M.S fabricated, common base plate, coupling, coupling guard, foundation bolts etc. as required.
- d. Suitable cement concrete foundation duly plastered and with anti-vibration pads.
- e. and complete set shall be mounted on common base frame. Batteries & battery leads with stand, Fuel tank (for 6 Hrs. operation & double container type) with stand & gauge glass, Fuel piping with valves. The quoted rate shall include water re - circulation piping, Pressure relief valve, radiator water cooling piping (if required) coupling guard and other standard accessories, foundation bolts, etc. complete as per the manufactures recommendations.

B. Supplying, installation, testing and commissioning of electric driven pressurization pump (Jockey Pump) suitable for automatic operation and consisting of following, complete in all

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respects, as required: (Jockey Pump-180 LPM, Rated Head: 88-meter, Pump MOC: Casing - Cast Iron, Impeller - Bronze, Shaft - SS, Motor: 9.3 KW (12.5 HP), 2 Pole, 3Phase, 50Hz.)

- a. Horizontal type, multistage, centrifugal pump of cast iron body and bronze impeller with stainless steel shaft, mechanical seal conforming to IS: 1520.
- b. Suitable HP squirrel cage induction motor TEFC type suitable for operation on 415 volts, 3 phase 50 Hz AC supply with IP 55 class of protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS: 325.
- c. M.S. fabricated Common base plate, coupling, coupling guard, foundation bolts etc. as required.
- d. Suitable cement concrete foundation duly plastered and with anti-vibration pads.

C. Supplying, installation, testing and commissioning of Electric driven Main Fire Pump suitable for automatic operation and consisting of following, complete in all respects, as required:

- a. Horizontal type, multistage, centrifugal, split casing pump of cast iron body & bronze impeller with stainless steel shaft, mechanical seal conforming to IS 1520.
- b. Suitable HP Squirrel cage induction motor, TEFC, synchronous speed 1500 RPM, suitable for operation on 415 volts, 3 phase 50 Hz, AC supply with IP 55 protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS-325.
- c. M.S. fabricated Common base plate, coupling, coupling guard, foundation bolts etc. as required.
- d. Suitable cement concrete foundation duly plastered with anti-vibration pads.
- e. 2280LPM with 88-meter head and as to give a minimum 3.5kgf/cm² pressure at the highest/farthest point.

D. Supplying, installation, testing and commissioning of electric driven terrace pump suitable for automatic operation and consisting of following, complete in all respects, as required: (**Terrace Pump** /Water Curtain system)

- a. Horizontal type, multistage, centrifugal, split casing pump of cast iron body & bronze impeller with stainless steel shaft, mechanical confirming to IS: 1520
- b. Suitable HP squirrel cage induction motor TEFC type suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply with IP55 class of protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS-325.
- c. M.S. fabricated common base plate, coupling, coupling guard, foundation bolts etc. as required.
- d. Suitable cement concrete foundation duly plastered and with anti-vibration pads.

E) Fuel System & Cooling System

- a) The diesel engine is to run-on high-speed diesel, the tank provided being enough to hold the volume required for 6 hours (minimum) continuous operation. The tank shall be of MS sheet of 1.6mm thickness.
- b) The diesel engine shall be cooled by a Heat Exchanger and the contractor shall make arrangement for continuous supply of such water.
- c) A frame of engine mounted air-cooled radiator with a multiple belt driven fan from the engine. The water in the closed circuit shall be circulated by means of the auxiliary pump driven by the engine and the capacity of the closed circuit shall be not less than that recommended by the Engine manufactures.

F) Accessories

- a) The engine shall be mounted on a base plate of fabricated steel construction. Adequate access shall be provided to the big end and main bearings, camshaft and governor drives, water jackets etc.
- b) The engine shall have a base plate made from M S sections. There shall be reasonable space at the big end, camshaft, water jackets, governor drives and main bearings.
- c) The engine shall be provided with intake and discharge duct work, inlet filter and silencer, outlet muffler, expansions joints, damper etc. as necessary for efficient operation. Intake air shall be taken from inside the building in which the engine is located, but the exhaust shall be discharged into the air at a location as desired by the Architect / Employer.

G) Instrumentation

The diesel engine shall be provided with adequate instrumentation. The gauges etc. as required are provided for in the engine panel.

n) Pressure Gauges

- a) All pressure gauges shall be of dial type with Bourdon tube element of SS 316. Gauges shall be filled with gel of reputed make. Dial size shall be 150 mm dia. and scale division shall be in metric units marked clearly in black on a white dial.
- b) All pressure gauges shall be complete with isolation cock, copper tube, nipples, tail pipes etc.
- c) Dial gauges shall have adequate response for the pressures encountered within the specified (Range 0- 25Kg/sq.cm).
- d) Calibration certificate shall be obtained and submitted for each pressure gauge.
- e) Pressure gauges shall be as per the approved manufacturer list.

o) Pressure Switches

- a) Pressure switches shall be industrial type single pole double throw electric pressure switch designed for starting or stopping of equipment when the pressure in the system drops or exceeds the pre-set limits. It shall comprise of a single pole change-over switch, Bellows' element assembly and differential spindle.
- b) All pressure switches shall have 6 mm B.S.P. (Table F) inlet connection & screwed cable entry for fixing cable gland.

p) Pump Indicator

The following audible and visible indication shall be provided at the pump local control panels as applicable

- a) Red "no flow" indicator with buzzer for the associated water tanks.
- b) Amber "low water level" indicator.
- c) Red "pump trip" indicator for each pump.
- d) Green "pump on" indicator for each pump.
- e) "Pump electrical supply healthy" indicator for each pump.
- f) Amber "remote/local" status indicator.

q) Automatic Level Control System

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- a) Contractor shall provide an automatic level control system to automatically shut off pumps depending on the water level.
- b) When water reaches predetermined low level, an audio-visual alarm shall sound and the pump shall shut off automatically. The alarm shall have a manual switch, which will enable the operator to manually switch it off prior the alarm.
- c) Water pumps shall behave accordingly:
 - a) High level alarm (over-flow)- none
 - b) Low level alarm- turn off pump
 - c) Earthing probe.
 - d) Alarm for no flow condition
 - e) All status to be sent to the IBMS

6.2 Execution

6.2.1 Installation

- a) Install control panel and alarm panel as shown on drawings.
- b) Level controls shall be installed as per the manufacturers printed installation instructions. Wire level controls and pump power cords to panels.
- c) Provide union, check valve and isolation valve and flexible connectors at each pump discharge line. Provide isolation valve, strainers, and flexible connectors at pump suction line. Provide minimum 75mm plumbing vent.
- d) Submit detailed flow verses head calculations and pump performance curves for review.
- e) All installation shall be strictly as per Final approved shop drawing.

6.3 Testing and Commissioning

6.3.1 Testing

Pump shall be tested at the factory to determine the following:

- a) Suction on lift or head and Discharge against the specified head when running at the rated speed under Specified.
- b) Power absorbed by the pump at the pump shaft (BP) under the above specified conditions and Efficiency of the pump under the above specified conditions.
- c) Pumps shall be tested at manufacturers works and a test certificate furnished before supply and tested at site after installation as per procedure as per clause 13 of 5120 - 1968.

6.3.2 Commissioning

- a) Commissioning of the Fire Hydrant and Sprinkler Systems shall be done to the Satisfaction of Owner/ Consultant and shall commence only after:
 - i.) All piping, accessories, pumping sets, fire alarm etc. have been completely installed and tested to the satisfaction of the Owner/Consultant.
 - ii.) Electrical connections have been made and direction of motor rotation checked.
 - iii.) Related work by other agencies has been completed in all respects.
 - iv.) Water supply is available in adequate quantity in the tank.
- b) On completion of all related works given above, start pumping set and develop desired pressure in the system.

- c) By opening one hydrant or test valve in sprinkler system, first the jockey pump shall start automatically at desired drop in pressure and then on further fall of pressure, the main pump(s) shall start. If required, make adjustment and retest. Similarly, the stand-by pump shall also be tested for automatic starting at desired drop of pressure. While main fire pump(s) shall be suitable for manual shut-off, the jockey pump shall start and stop automatically by drop of pressure and build-up of pressure respectively.

6.3.3 Fire Protection System Testing

- a) The entire works included in this Contract shall be fully tested in stages as the work proceeds and on completion of work as applicable.
- b) The Contractor shall provide all necessary labour, instruments, equipment, materials, fuel, power and manufacturer's representatives to carry out such tests as may be necessary to satisfy the client / consultant that the installation meets the requirement and intent of the Specification as well as such tests required by Local Authorities.
- c) All tests shall be made in the presence of the client / consultant or his representative or any inspecting authority. At least seven working days' notice in writing shall be given to the inspecting parties before performing any test.
- d) Three copies of all test results shall be submitted to the client on paper within two weeks after completion of the tests.
- e) Tests described hereinafter and including all tests prescribed by the Authority having jurisdiction shall be carried out. Any tests proved unsatisfactory shall be repeated to the satisfaction of the inspecting parties.
- f) Contractor shall submit hydraulic calculations, shop drawings along with necessary orifice plate selections for approval.
- g) All piping in the system shall be tested to 16 bar hydrostatic Pressure as indicated elsewhere in this section.
- h) The pressure shall be maintained for a period of not less than 24 hours.
- i) Contractor shall rectify leakages, if any, and replace all defective components and re-test the system as per above requirements to the satisfaction of Project Manager / Consultant.
- j) At least 10% of all the welded joints including field joints shall be radio- graphically tested.
- k) After testing, all pipes shall be flushed with domestic water to remove foreign material.

Fire Protection System

- a) Check all hydrant valves by opening and closing any valve found to be open shall be closed.
- b) Check all the piping under hydro test.
- c) Check that all suction and delivery connections are properly made for all pump sets.
- d) Check rotation of each motor after decoupling and correct the same if required.
- e) Tests run each pump set.

- f) All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).
- g) Commissioning and Testing

7. Fire Extinguishers: General Requirements:

- a) Fire extinguishers shall be worked out in such a way that the Occupants shall not travel more than 15m to reach a Fire extinguisher.
- b) There shall be a Fire extinguisher for every 300 sq. meter of floor plate of suitable type /size.
- c) Extinguishers shall be provided at surface car parks, outdoor transformers / electrical installations and on the landing of each staircase of all floors as indicated in the drawings.
- d) Operating instruction shall be pasted on the extinguisher body.
- e) Portable fire extinguishers shall be BIS approved and valid ISI certificates to be furnished at the time of delivery to site.

7.1 TYPE OF FIRE EXTINGUISHERS

- a) Water Type Fire Extinguishers: It should be of gas cartridge type, provided with squeeze grip control valve operating mechanism overall conforming to IS 15683 and ISI marked.
- b) Dry Chemical Powder (DCP/ABC) Type Fire Extinguishers: It should be of gas cartridge type provided with squeeze grip control valve operating mechanism overall conforming to IS 15683 and IS marked.
- c) Carbon Dioxide Type Fire Extinguishers: It should be of wheel type control valve operating mechanism over all conforming to IS 15683 and ISI Marked.
- d) Clean Agent Type Fire Extinguishers: It should be pressurized provided with squeeze grip control valve operating mechanism overall conforming to IS 15683 and IS marked.
- e) Note: All components of above fire extinguishers should satisfy the requirements of construction material, dimensions, sizes, ratings, tests criteria and all other requirements as per IS 15683:2006 and it should be overall conforming to IS 15683 with ISI mark.

8.0 NOVEC SYSTEM:

9.0 Factory Tests

The following tests shall be performed in the presence of the Owners Representative.

- a) Main Switchboard
- b) Inspection of switchboard including wiring, electrical and mechanical connections.
- c) Mechanical tests.
- d) Primary and secondary injection tests to commission and calibrate all measuring, protection and control circuits and associated components.
- e) Continuity and dielectric tests.
- f) Power frequency and pressure test.

- g) Functional check of all control wiring.
- h) Valves, Cocks, Fittings & Fire Fighting Accessories
- i) Type-Test' and approval certificate for pressure test and compliance with the regulations laid down by the Local Authority / Standards / Project Manager.
- j) All major equipment's should be factory tested and contractor shall allow for factory visit for witnessing of client & consultant.
- k) Fire pumps

9.1 On -Site Testing and Commissioning

9.1.1 General

- a) The contractor shall allow sufficient time prior to completion of contract work, the Contractor shall liaise and submit for the client's approval a detailed programme for conducting on-site acceptance tests and commissioning.
- b) The Contractor shall start up, operate, test and adjust the systems in accordance with the agreed programme. The setting shall be supervised by the manufacturer's representative, who shall remain onsite until the equipment is operating satisfactorily and accepted by the Client. The Contractor shall advice and coordinate with the manufacturer's representatives so that all testing is carried out according to the agreed programme.
- c) The whole installation shall be given the following tests to bring the systems into running order. The Client shall be given reasonable notice together with a copy of recorded test results, generally not less than seven (7) days, regarding the nature of tests, the time and location. Acceptance tests will only be witnessed by the Client when the submitted tests results are found satisfactorily.
- d) All instruments, tools, material, and labour required to perform these tests shall be provided by this Contractor.
- e) Before the tests are carried out, the Contractor shall remove connected equipment and components which are liable to damage under test, and shall provide and fix all the necessary gauges, blanking flanges, etc.
- f) Prior to the system start-up, the following inspection, tests, and pre-commissioning treatment shall be carried out by the Contractor

9.1.2 Tanks and Level Switches

Check sides and edges of sectional tanks for distortion. The tanks shall be thoroughly cleaned with water and drained. Also, the level switch shall be simulated for the various cut-in and cut-out settings.

9.1.3 Pressure Switches.

- a) The testing equipment arrangement for pressure switches and pressure gauges shall be as shown on the approved shop drawings.
- b) The pressure gauges to be tested shall be connected as shown on the approved shop drawing in lieu of the pressure switch. The gauges to be tested shall be regarded acceptable when the pressure readings of all three gauges are the same throughout the jacking pressure range varied by applying the hand pump.

g) Hydrostatic Tests

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- a) All parts of the water circuit shall be filled with water before hydrostatic pressure testing, and pump running tests for verification of pressure and flow rate, are conducted.
 - b) The hand-jacking pump shall be applied to increase the system pressure to 1.5 times the working pressure but in any case, not less than 10 bar for water supply and 6 bar for drainage. The pressure shall be maintained for a period not less than 24 hours.
 - c) Where any section of pipe work or equipment is found to be unable to withstand the maximum pipe work test pressure, it shall be isolated during the pipe work test then that section of pipe work or equipment shall be made good and re-tested at the appropriate test pressure.
 - d) The working pressure for various systems shall be estimated by contractor and submit for approval to the consultant.
 - e) All valves and accessories etc. should be factory tested at 1.5 times of its design working pressure system pressure.
- h) Drains**
- a) House drains shall be hydrostatically tested to a water head of 1.2 m at the high end and not more than
 - b) 2.4m at the low end and shall show no appreciable loss of water after elapse of two hours.
 - c) In every test, water used shall be left in the pipes until they are covered with earth or other trench filling material to a depth of at least 1 m over the top of pipes and until permission is given by the client/consultant for the water to be released. If after the client/consultant has approved the sewer or pipeline and has given permission for the trenches to be refilled the pipes become damaged and loses water from any cause and/or admit subsoil water, the Contractor shall uncover the pipes and make good the defect and the pipes retested as before and all at the Contractor's expense.
- i) Cleaning, Flushing, and Pre-Treatment**
- a) Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fittings and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
 - b) All strainers shall be inspected and cleaned out or replaced.
 - c) When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
 - a) Remove oil, grease and foreign residue from the pipe work and fittings.
 - b) Pre-condition the metal surfaces to resist reaction with water or air.
 - c) Establish an initial protective film

- d) After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
- e) Details and procedures of the pre-treatment shall be submitted to the client/consultant for approval.

j) Electrical Tests

- a) Electrical tests shall comply with the current edition of IEE regulations and requirements enforced by Local Authorities.
- b) Electrical insulation tests earth electrode resistance test and cost amenity test shall apply to bus bars, isolators and other equipment and wiring where applicable.
- c) A 500V DC instrument shall be used to check the insulation resistance. The reading shall not be less than 1 mega-ohm in all instances.
- d) Function simulation tests shall be performed to ensure that the systems have been installed to the control requirements as described in the Specification therein.

Pump Drives

- a) The direct coupling of the pump drives shall be dismantled before the pump motor control panel is energized.
- b) The Contractor shall demonstrate to the client/consultant of acceptable clearances of the coupling alignment for ensuring satisfactory power transmission.
- c) The coupling shall not be re-mated again till the correct motor rotation has been demonstrated with power drawn from the energized pump motor control panel.

l) Pump Operating Test

- a) The Contractor shall ensure to the satisfaction of the client / consultant that the installation or portion thereof which has been set to work complies with all requirements including the following:
- b) That the plant and apparatus shall be of robust construction and of capacity for the duty specified.
- c) That all valves, switches, controls and the like are properly regulated and capable of proper operation and in the case of valves are capable of being shut-off.
- d) That all apparatus shall be silent.
- e) That all instruments are correctly calibrated and read accurately.
- f) That all services are tested in accordance with the details of the relevant clauses of this Specification.

9.2 Statutory Authorities Tests and Inspections

- a) As and when notified in writing or instructed by the client/ consultant, the contractor shall submit shop drawing and attend all tests and inspections carried out by Local Authorities and other Statutory Authorities shall forthwith execute free of charge any rectification work ordered by the client/ consultant as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

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- b) The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.
- c) The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the client/consultant for checking before submission. The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The client/consultant may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.
- d) The Contractor shall notify the client/consultant at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the client/consultant without delay.

9.3 Preliminary Commissioning Checks

- a) Ensure that all equipment & system is thoroughly cleaned, lubricated and checked for serviceability before setting to work. Particular attention is drawn to the removal of building debris from the pipe work systems.
- b) Special attention is drawn to the need for thoroughly flushing out all pipe work systems to ensure that all foreign matter is removed.
- c) All automatic controls and safety devices shall be inspected and checked for serviceability before the working fluid or electricity is applied to the system.

9.4 Commissioning

When the various installations have been completed and the preliminary commissioning checks carried out, the Contractor shall set to work, regulate, and calibrate all system in the entire installation. Special attention shall be paid to the following items:

- a) That all valves, switches, controls, etc. are regulated and capable of proper operation and in the case of isolation valves that they are capable of tight shut off.
- b) That all apparatus is silent in accordance with the requirements of this Specification.
- c) That all instruments are correctly calibrated and read accurately.
- d) That all services are tested in accordance with the details in the relevant clauses of this Specification.
- e) Operate pumps, pressure reducing sets, etc. to ensure that all control systems are functioning correctly and are properly set, sequenced, or interlocked

9.5 Final Acceptance Tests

- a) Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the client/consultant.
- b) Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary, replace the equipment without further payment in order that the required performance is obtained.

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- c) Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.
- d) Final approval of commissioning of the equipment is subjected to clearance of commissioning consultant and the Fire officer, SBI LHO Bhubaneswar.

9.6 Rejection of Plant

- a) Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the client/consultant either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the client/consultant so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/client/consultant.
- b) After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Employer.

9.7 Handing Over of Documents

- a) All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Client and all testing and commissioning documents shall be handed over to the Client.
- b) The Contractor shall also hand over all maintenance and operation manuals, all certificates, and all other documentation as per the terms of the contract to the Client.

10. List of Approved Makes for Fire Fighting System

| LIST OF APPROVED MAKES – FIRE FIGHTING | | |
|--|-----------------------------|--|
| A | Mechanical works | |
| 1 | Fire Pump Set | Mather + Platt / KIRLOSKER/KSB / Grandfous or EAM |
| 2 | Pipe Fittings | Bharat Forge / Jainsons /VS Brand /B & M/Sant |
| 3 | Butterfly Valves | Shah Bhogilal / KBL / Upadhya/ Kalpana/ Kartar/Zoloto/Audco or equivalent |
| 4 | Non – Return Valves | Sant/Jainsons/Audco/Shah Bhogilal / KBL / Upadhya/ Kalpana/ Kartar/Sant or equivalent |
| 5 | Gate Valves (Screwed End) | Shah Bhogilal / KBL / Upadhya/ Kalpana/ Kartar/Zoloto/Audco /Sant or equivalent |
| 6 | G.I./ M.S. Pipes | Jindal (Hissar) / Tata |
| 7 | Strainers | Sant/Gujrat Oto Filt / Grand / Frix/ Tel Flow, Leader, Prime, Kartar, Hammer, Kalpana, Worth or equivalent |
| 8 | C.I. Gate Valves | Sant/Kirloskar/Jainsons |
| 9 | Flow Meter | Forbes Marshall / Eureka |
| 10 | Pressure Switch | Indfos / Switzer / Delta Control |
| 11 | Pressure Gauge (Gel filled) | H. Guru / Fiebig / Pricol |
| 12 | Anticorrosive Material | I W L / Rustech//Rapidrop |

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| | | |
|----------|---|--|
| 13 | Hydrant Valves | AAAG/Newage /Winco /Minimax |
| 14 | Branch Pipe with Nozzle | AAAG/Newage /Winco /Minimax |
| 15 | Fire Hoses | AAAG/Newage /Winco /Minimax |
| 16 | Hose Couplings | AAAG/Newage /Winco /Minimax |
| 17 | Hose Reel | AAAG/Newage /Winco /Minimax |
| 18 | Hose Box / Fire Duct Shutter | AAAG/Newage /Winco /Minimax |
| 19 | Fire Extinguishers | Minimax / KANEX / LIFE GUARD / SAFEX |
| 20 | Sprinklers/Water tain/flexible hoses | cur- Tyco / Viking |
| 21 | Sprinkler Alarm Valve | Tyco / Viking |
| 22 | Flow Switch | System Sensor / Potter /Switzer/Rapidrop |
| 23 | Paint | Asian / Berger |
| 24 | Air Release Valves | Leader / Bajaj / Hawa/Rapidrop |
| 25 | Welding Electrodes | Esab 28/ Advani |
| B | Electrical Works | |
| 1 | Electric Motors | Grandfous / Kirloskar /Greaves /Siemens/ABB |
| 2 | Motor Control Centre | Vinteck power control / Pragathi Controls / Load Controls / Dynamo / Bright Engineering/Ellins / Lotus |
| 3 | Control / Power Cables | Gloster / Universal / Asian /CCI/ Finolex |
| 4 | Mccb | GE/L&T/Alstom/Merlengerin |
| 5 | Cable Tray | Storack / Pan / Mag |
| 6 | Control Mcb | Abb/ Merlengerin / Siemens / Mds |
| 7 | Voltmeter Select Switch | Salzer / L & T / Kaycee |
| 8 | Voltmeter (Ac / Dc) | Meco / AE |
| 9 | Ammeter (Ac / Dc) | Meco / AE |
| 10 | Power Contactors | Abb / Siemens /L&T/ Schneider |
| 11 | Indicating Laps (Led Type) | Binay / Teknic |
| 12 | Push Buttons | Teknic / Siemens |
| 13 | Auto / Manual Selector | Salzer / Kaycee |
| 14 | Timers | Eapl / AE |
| 15 | Terminal Blocks | Elmex / Wago |
| 16 | Current Transformers | Kalpa / Voltamps / Kappa |
| 17 | Overload Relay | L & T / Siemens |
| 18 | Single Phase Preventors | Minilec / Ae |
| 19 | Siren / Hooter | Kheraj/Equi. |
| 20 | End Terminations | Dowewls / Multi |
| | | |

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| C | Fire Detection & Alarm with P.A. System | |
|----|--|---|
| 1 | Smoke Detectors | Notifier/Simplex/Bosch/Fyrlaast |
| 2 | Heat Detectors | Notifier/Simplex/Bosch/ Fyrlaast |
| 3 | Main Control Panel | Notifier/Simplex/Bosch/ Fyrlaast |
| 4 | Manual Pull Stations | Notifier/Simplex/Bosch/ Fyrlaast |
| 5 | Hooters / Strobes | Notifier/Simplex/Bosch/ Fyrlaast |
| 6 | Modules | Notifier/Simplex/Bosch/ Fyrlaast |
| 7 | Battery | Hitachi / / Exide / Standard |
| 8 | Copper Conductor Control | Polycab / Varsha/ Anchor/Ravicab/ Finolex |
| 9 | Communication Wires | Polycab / Varsha/ Anchor/Ravicab/ Finolex |
| 10 | M S Conduits | Bharath / GB / Prince |
| 11 | PVC Conduits | VIP / Precision / Nelco |
| 12 | Talkback system | Samrt Mindz/Heinrich/Airlight |
| 13 | PA Speaker | Bosch / TSG Optimus/ praesensa/zenitel |
| 14 | PA Amplifier | Bosch / TSG Optimus/ praesensa/zenitel |
| 15 | PA Controller | Bosch / TSG Optimus/ praesensa/zenitel |

Note:

- a) The Contractor shall offer all materials for inspection prior to dispatch. All materials not otherwise specified shall be in accordance with the latest Indian Standard Specification, or with Standards as listed in the Contract documents.
- b) The Contractor - where deemed necessary by the Client and at the Contractors expense - shall be bound to offer samples of materials, which are claimed to be conforming to IS Specifications, for testing at an approved Test Laboratory.
- c) The Contractor shall purchase all materials from the makers or their authorized stockiest only. Necessary Purchase Orders / Delivery Dockets or such documentary evidence as deemed necessary must be provided to the Client on demand.
- d) If any of the make for above materials is not available, then Architect/ Client reserves the right to suggest/ approve the alternate make for the same.
- e) Till the closure of the project any equipment failure at site will be the responsibility of the contractor.

11. DRAWINGS : As provided by the Architect/Employer.

12. GENERAL SAFETY TERMS AND CONDITIONS

1.0 LABOUR LAWS

- a) No Labour below the age of eighteen (18) years shall be employed on Work. In case female workers are engaged, requisite provisions shall be made as per the statute.
- b) Vendor shall not pay less than what is provided under law to laborers engaged by him on Work.
- c) Vendor shall at his expense comply with all labor laws and keep SBI indemnified in respect thereof.
- d) In addition to above, rules and regulations as contained in Contract Laborer (Regulation and Abolition) Act, 1970 will also be applicable for this contract.

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- e) Vendor shall secure full safety of the workers / employees engaged by him in the Site premises and shall take at his own cost, insurances and such other safety regulations for the said purpose.

2.0 INSURANCE

- a) Vendor shall at his own expense carry out and maintain insurance with reputable companies to the satisfaction of the SBI as follows:
- b) Employee's Compensation and Liability Insurance:
- c) Vendor shall obtain Workmen Compensation policy in his name in respect of Vendor's employees to be engaged for the work towards compensations as admissible under the Employee's Compensation Act, 1923 and Rules framed there under upon death/ disablement and also medical treatment of a worker and the same has to be produced to the Bank's Engineer before start of the work. SBI should be mentioned as the Beneficiary.

3.0 HSE REQUIREMENTS BY VENDORS

A. Housekeeping:

- a) Vendors shall ensure that their work area is kept clean, tidy and free from debris. The work areas must be cleaned on a daily basis. Any disposal of waste shall be done by the Vendor.
- b) All equipment, materials and vehicles shall be stored in an orderly manner. Access to emergency equipment, exits, telephones, safety showers, eye washes, fire extinguishers, pull boxes, fire hoses, etc. shall not be blocked or disturbed.

B. Confined Space:

Before commencing Work in a confined space, the Vendor must obtain from SBI a Permit to Work, the Permit to Work will define the requirements to be followed. As minimum Vendors must ensure the following:

- a) Confined spaces are kept identified and marked by a sign near the entrance(s).
- b) Adequate ventilation is provided
- c) Adequate emergency provisions are in place
- d) Appropriate air monitoring is performed to ensure oxygen is above 20%.
- e) Persons are provided with Confined Space training.
- f) All necessary equipment and support personnel required to enter a Confined space is provided.

C. Tools, Equipment and Machinery:

The Vendor must ensure that all tools & equipment provided for use during the Work is:

- a) Suitable for its intended use.
- b) Safe for use, maintained in a safe condition and where necessary inspected to ensure this remains the case (any inspection must be carried out by a competent person);
- c) Used only by people who have received adequate information, instruction, and training to use the tool or equipment.

- d) Always provided with Earth leakage circuit breaker (ELCBs) when using electric power cords. Use of electrical tape for temporary repairs is prohibited.

D. Working at Height:

Any Work undertaken where there is a risk of fall and injury is considered to be working at height. For any Vendor Personnel working at height, Vendors shall provide fall prevention whenever possible and fall protection only when fall prevention is not practicable. Before commencing Work in a height, the Vendor must obtain from SBI a Permit to Work, the Permit to Work will define the requirements to be followed. Supervisor must be present at all point of time, to ensure no deviation occur during work.

E. Fall Prevention System:

Fall prevention systems (e.g., fixed guardrails, scaffolds, elevated work platforms) must provide protection for areas with open sides, including exposed floor openings.

F. Fall Protection Systems:

Where fall protection systems are used then the Vendor must ensure the following is applied:

- a) Only approved full body harness and two shock-absorbing lanyards are used,
- b) Prior establishment of a rescue plan for the immediate rescue of an employee in the event they experience a fall while using the system,
- c) Anchorage points must be at waist level or higher; and capable of supporting at least the attached weight,
- d) Lifeline systems must be approved by SBI before use.
- e) Use of ISI marked industrial helmet at all point of time.

G. Scaffolding:

- a) All scaffolds shall subject to a documented inspection by a competent person and clearly marked prior to use. The footings or anchorage for scaffolds shall be sound, rigid and capable of carrying the maximum intended load without settling or displacement. All scaffolding materials should be of MS tubular type.
- b) Guardrails and toe-boards shall be installed on all open sides and ends of scaffold platforms. Scaffolds shall be provided with an access ladder or equivalent safe access. Vendor Personnel shall not climb or work from scaffold handrails, mid-rails or brace members.

H. Stairways and Ladders:

- a) Ladders should only be used for light duty, short-term work or access in line with the below and the Site Requirements.
- b) Fabricated ladders are prohibited.
- c) Ladders will be secured to keep them from shifting, slipping, being knocked or blown over.
- d) Ladders will never be tied to facility services piping, conduits, or ventilation ducting.
- e) Ladders will be lowered and securely stored at the end of each workday.
- f) Ladders shall be maintained free of oil, grease, and other slipping hazards
- g) Ladders will be visually inspected by a competent person and approved for use before being put into service. Each user shall inspect ladders visually before using.

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- h) Ladders with structural defects shall be tagged "Do Not Use," immediately taken out of service, and removed from the Site by the end of the day.

I. Lifting Equipment and Accessories:

- a) All lifting equipment / accessories e.g., slings, chains, webbing, chain blocks, winches, jacks etc shall be indicated with their safe working load have an identification number visible on the unit and be inspected and tested in accordance with legal requirements.
- b) Damaged equipment / accessories and equipment shall be tagged "out of use" and immediately removed from Site.

J. Lockout Tag out ("LOTO"):

Prior to performing work on machines or equipment, the Vendor shall ensure that it is familiar with LOTO and Permit to Work procedures and that all of its affected Vendor Personnel receive the necessary training.

K. Barricades:

- a) Floor openings, stairwells, platforms and walkways, and trenching where a person can fall any distance shall be adequately barricaded and where necessary, well lit. Where there is a risk of injury from a fall then rigid barriers must be used.
- b) Barricades must also be used to prevent personnel entering an area where risk of injury is high e.g., during overhead work activity or electrical testing etc. Such barricading must provide clear visual warning. Compressed Gas Cylinders
- c) Gas cylinder shall be securely stored and transported and identified and used in line with the local requirements. Hose lines shall be inspected and tested for leaks in line with local requirements. Flash back arrestor to be used to prevent any explosion due to backfire.

L. Electrical Safety

Prior to undertaking any work on live electrical equipment, the Vendor must obtain a Permit to Work from SBI. Wherever possible live work should be avoided. Any control measures highlighted shall be implemented prior to work commencing. The below measures will be taken:

- a) Work practices must protect against direct or indirect body contact by means of tools or materials and be suitable for work conditions and the exposed voltage level.
- b) Energized panels will be closed after normal working hours and whenever they are unattended. Temporary wiring will be de-energized when not in use.
- c) Only qualified electrical Vendor Personnel may enter substations and/or transformer and only after being specifically authorized by SBI.
- d) Electrical Safety device such as ELCB, MCB, RRCB etc to be provided before making connection.

M. Hot Works:

- a) A Permit to Work must be obtained from SBI prior to any hot works (welding, grinding, open flame work). Suitable fire extinguishing equipment shall be immediately available. Objects to be welded, cut or heated shall be moved to a designated safe location, or, if they cannot be readily moved, all movable fire hazards in the vicinity shall be taken to a safe place. Personnel working around or below the hot works shall be protected from falling or flying objects.

- b) Prior to the use of temporary propane or resistance heating devices approval must be obtained from SBI.

N. Trenching, Excavating, Drilling and Concreting:

- a) A Permit to Work must be obtained from SBI and all underground lines; equipment and electrical cables shall be identified and located prior to beginning the work. The Vendor shall assign a competent Vendor Personnel to all trenching and excavation work.
- b) Safe means of access and egress shall be located in trench excavations. Daily inspections shall be conducted by a competent Vendor Personnel for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems or other hazardous conditions. Physical barriers shall be placed around or over trenches and excavations.

O. Environmental Requirements:

- a) **Waste Management:** The Vendor is responsible to remove any waste generated by the work being done on the Site. The Vendor must dispose of the waste in line with the relevant local legislative requirements. The waste disposal route shall be documented and made available for SBI to review at any time and may be subject to SBI's prior approval.
- b) Wastes (includes rinse from washing of equipment, PPE, tools, etc) are not to be poured into sinks, drains, toilets, or storm sewers, or onto the ground. Solid or liquid wastes that are hazardous or regulated in any way are not to be disposed of in general site waste receptacles.
- c) **Spills:** The Vendor is responsible for the provision of adequate spill kits/protection and the clean-up and disposal costs arising from such spills.
- d) **Emissions:** The Vendor shall identify and quantify any emission sources associated with the Works. The control measures associated with these emissions shall be subject to the approval of SBI's Emissions include but are not limited to noise, dust, fumes, vapours.

P. Gas Cutting Activity:

- a) The gas cylinder shall be carried in a trolley.
- b) The rubber hose fitted to the gas cylinder shall of good quality and sufficiently long.
- c) The gas cylinder shall be fitted with gas regulator and pressure gauges which must be in good working condition. Non-return valve shall be provided on the gas cylinder to prevent back fire.
- d) All the joints on gas cylinder, gas cylinder valves, gas holder connection, gas rubber hose joints etc shall be free from any type of leakage.
- e) The operator shall wear helmet, hand gloves, safety goggles, shoes etc while carrying out the activity. While working at height safety belt shall be used. The operator shall use gas lighter to light the gas.
- f) The workplace and its surrounding areas shall be free from any flammable or combustible materials.
- g) The gas cylinder shall be kept away from any hot object.
- h) The gas hose shall be kept away to prevent any contact with the hot falling material.
- i) The area below and its surrounding shall be free from any other activity or cordon off.

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- j) Fire extinguishing medium like fire extinguishers, water or sand shall be available at the workplace.
- k) After completion of the job close the valve of the gas cylinder and discharge the gas from the gas hose. Keep the gas cylinder and gas pipe in a proper place.

D. GENERAL REQUIREMENTS AND MINIMUM TECHNICAL SPECIFICATIONS OF FIRE SAFETY AUTOGLOW SIGNAGES FOR External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar

1) GUIDELINES FOR THE OEM:

OEM should have online dedicated support center available during working hours and a fully equipped repair and maintenance office in India. Document details to be submitted for the same for verification.

- a) OEM should have valid BIS Certification.
- b) Documents of Manufacturing license/ Excise Registration of the OEM factory need to be submitted for verification.
- c) Product Certification copies to be attached as per the specifications.
- d) Vendor will be responsible for non-genuine products. Audit for Banks whether actual material is provided or not needs to be done by OEM, as and when required by Bank, without any additional cost, as a service support to Bank.

2) WARRANTY & GUARANTEES:

The supplier should also give guarantee for the Auto glow Signages and LED Based Emergency Lights as per OEM recommendation. The supplier must warrant all equipment, accessories, spare parts etc., against any manufacturing defects during the warranty period. Service Provider shall be fully responsible for the manufacturer's warranty in respect of proper design, quality, and workmanship of all equipment, accessories, etc.

3) The following specifications required for flexible sheet and rigid sheet auto glow signage:

| S. No. | Particulars | Flexible Sheet signage | Rigid Sheet signage |
|----------------------|-----------------------------------|--|--|
| Glow signage: | | | |
| I. | Description | Flexible signage should be photo luminescent based glow-in-dark sheeting with luminous properties enclosed in a weatherproof UV stabilized film with UV screen printing. | Rigid signage (on Acrylic sheet) should be photo luminescent based glow-in-dark rigid sheet with high intensity luminous properties enclosed in a transparent weatherproof UV stabilized coated sheet, with UV screen printing (lamination). |
| II. | Thickness and service temperature | 0.2 mm (+/-: 10%), -20 to +120 °C | 1mm (+/-: 10%), -20 to +120 °C Sheet thickness 2.5 to 3.0 mm |
| III. | Surface Colour | Greenish yellow | Greenish yellow |
| IV. | Visibility | Glow visible up to 1-2hrs in total darkness | Glow visible up to 1-2hrs in total darkness |
| V. | Properties | Fungi static, Nontoxic, Non-radioactive, contains no lead or phosphorous, Simple to install by pasting and Self extinguishing | Fungi static, Nontoxic, Non-radioactive, contains no lead or phosphorous, Simple to install by screwed or just peel off to stick and Self extinguishing |
| VI. | Life | Life > 10-15 years for best work- | Life > 10-15 years for best working |

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| | | | |
|--|----------------|---|-----------|
| | | ing in indoor | in indoor |
| VII. | Certifications | These signs adhere to BS: 5499-1 and the health & safety (safety signs & signage) regulation. | |
| LED CONFIGURED EMERGENCY (E)/NON-EMERGENCY EXIT (NE) EDGELIT LIGHT: | | | |
| a) Should be Ceiling mounted and confirmed IS:9583, b) The facia on clear acrylic and the arrow should be available, c) Facia on clear acrylic and the arrow should be Visible from both sides. d) Ni-Mh/Ni-Cd rechargeable battery with constant voltage charger and maintained battery backup for 02 hrs minimum, e) Input 230 V, 50Hz. f) Size should be 180mm x 300 mm in Aluminum Housing Body (25mm x 45 mm). | | | |

Also, the following specifications are required for Auto glow / Led Based Fire Safety Sign-ages must be followed by the applicants wherever required by the Bank Branches/Offices:

- i.) Is: 10322 (Part-5/Sec-8):2013 "Led Luminaries for Emergency Lighting.
- ii.) Is: 12349:1988 "Fire Protection-Safety Signs"
- iii.) Is: 9457:2005 "Safety Colors and Safety Signs"
- iv.) Is: 9583:1981 "Specification for Emergency Lighting Units"
- v.) National Building Code of India-2016

Note: The make quoted as per technical specification AND the information brochure for the signage should be enclosed.

4. LOCATION TO BE INSTALLED

| S. NO. | LOCATION TO BE INSTALLED |
|--------|---|
| 1. | Main EXIT door from inside |
| 2. | In banking hall or any gallery to indicate the EXIT gate (Left direction) |
| 3. | In banking hall or any gallery to indicate the EXIT gate (Right direction) |
| 4. | At the staircase landing area towards getting down direction |
| 5. | In banking hall or any gallery to indicate the EMERGENCY EXIT gate (Left direction) |
| 6. | In banking hall or any gallery to indicate the EMERGENCY EXIT gate (Right direction) |
| 7. | At each door both side |
| 8. | lift lobby for marking Outside Fire Lift |
| 9. | All floors / Near Stationary / Record room |
| 11. | Near fire alarm manual call point (MCP) |
| 12. | Near main electrical panel & master switch |
| 13. | Near hydrant point if hydrant system installed |
| 14. | Near the Fire Extinguishers |
| 15. | Safe area to be marked outside of the premises for assembly of the occupants in case of emergency |
| 16. | lift lobby above the lift entrance door centrally in the lift lobby on all the floors and one inside the Lift car |
| 17. | Near the Fire Alarm Panel ideally located near Exit Gate |
| 18. | Green Diagonal laminated scratch proof Tape on Flexile material for Marking safe area and exit door highlighting escape identification at staircase |
| 19. | Green Diagonal laminated scratch proof Tape on Flexile material for Marking |

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| | |
|-----|--|
| | safe area and exit door highlighting escape identification at staircase |
| 20. | Way Finding Tape on Flexile material laminated scratch proof for (Low location light), directional route marking way finding (Left / Right-handed directional) |
| 21. | To be pointed towards EXIT gates at each floor as per requirements. LED configured emergency (E) edge lit light: Should be Ceiling mounted Size should be 180mm x 400 mm in Aluminium Housing Body (25mm x 45 mm). |
| 22. | EXIT gates at each floor as per requirements Self-contained rechargeable emergency (LED MULTI LIGHTS WITH आपातकालीन निकास / EMERGENCY EXIT (Hindi & English both) & SIGNAGE) automatically switched-on mains power failure and provides illumination on battery source for specified duration |

SCHEDULE OF RATES

1. The schedule of rates should be read in connection with all the other sections of the tender.
2. The quantities shown against the items of work are only approximate and may vary to any extent. No extra whatsoever shall be entertained.
3. The rates inserted in the bills of quantities are to be for the full inclusive value of the work described under the several items, including all cost and expenses which may be required in and for the construction and full protection of the work described, together with all risks, liabilities, and obligations set forth or implied in the documents on which the tender is based. The quoted rates shall be for all heights, lifts, and lead unless otherwise mentioned specifically in the description of the item.
4. General direction and description of work and materials given elsewhere in the contractor documents are not necessarily repeated in the Bill(s) of quantities. Reference to be made to the other documents for the full information/details.
5. The contractor shall be deemed to have visited the site before quoting for the tender and to have examined for himself the conditions under which the work will be carried out including local conditions affecting labor and to have studied the items of the bills of quantities, the drawing and specification, relating to them and to have satisfied himself that the rates quoted by him provide for all minor accessories and contingent works or service as necessary for the works described even though there are not specifically defined.
6. Tenderer is advised to read items of works carefully and quoted the rates accordingly. However, if he quotes different rates for the same item(s) of work under different schedules of items, the lowest rates quoted shall be made applicable to all the Bill of Quantities and the contract sum shall be corrected accordingly.
7. Where an item of work not mentioned in a particular bill of quantities, is required to be executed and where the rate for such an item of work is quoted under a different bill of quantities forming a part of this contract, then the contractor being called upon shall execute the work and shall be paid at the rate so quoted. Nothing extra over shall be payable on this account.
8. The drawing(s) attached with this tender document are for the purpose of tender, giving the tenderer a general idea of the nature and the extent of works to be executed.
9. The rates quoted by the tenderer shall be deemed to be for the execution of the works in accordance with the "Construction Drawings" (to be supplied to the contractor at the "Design Aspect" of these drawings).
10. The rates quoted by the tenderer shall include all labor, tools and plants, materials inclusive of all, transport, loading, unloading charges, all levies, all taxes, excise duties, etc. at the time of quoting their rates. The quoted rates shall remain firm throughout the contract period. No escalation on prices of labor and materials shall be entertained.

LETTER OF UNDERTAKING

To,
The Assistant General Manager
Premises & Estate Dept.,
2nd Floor, J. N Marg, Kharvel nagar,
Bhubaneswar

Dear Sir,

EXTERNAL & INTERNAL RENOVATION OF LHO BUILDING (2ND TO 5TH FLOOR), BHUBANESWAR, ODISHA.

Having examined the terms & conditions, drawings, specifications, design relating to the works specified in the memorandum hereinafter set out and having visited and examined the site of the works specified in the said memorandum and having acquired the requisite information relating thereto and affecting the quotation, I/We hereby offer to execute the works specified in the said memorandum within the time specified in the said memorandum on the percentage rate basis mentioned in the attached schedule and in accordance in all respect with the specifications, design, drawings and instructions in writing referred to in conditions of Tender, conditions of contract and with such conditions so far as they may be applicable.

MEMORANDUM

| | | |
|-----|---|---|
| (a) | Description of work | External & Internal renovation of LHO building (2 nd to 5 th floor), Bhubaneswar, Odisha. |
| (b) | Earnest Money | Rs.19,29,000/- by means of Demand Draft / Pay Order from any scheduled Nationalized Bank drawn in favor of "SBI" and payable in "Bhubaneswar". |
| (c) | Time allowed for completion of work from the date of issue of work order. | 8 calendar months from the date of commencement as per tender. |

Should this tender be accepted, I/we hereby agree to abide by and fulfill the terms and provisions of the said conditions of Contract annexed hereto so far as they may be applicable or in default thereof to forfeit and pay to SBI, the amount mentioned in the said conditions.

I/we have deposited Demand Draft / Banker's Cheque / FDR for a sum of **Rs.19,29,000/-** as Earnest money deposit with the SBI. Should I/we do fail to execute the contract when called upon to do so, I/we hereby agree that this sum shall be forfeited by me/us to SBI.

We understand that as per terms of this tender, the SBI may consider accepting our tender in part or whole or may entrust the work of "External & Internal renovation of LHO building (2nd to 5th floor), Bhubaneswar, Odisha".. We, therefore, undertake that we shall not raise any claim / compensation in the eventuality of Bank deciding to drop any/part of the building / buildings from the scope of work of this tender at any stage during the contract period. Further, we also undertake to execute the work entrusted to us in phases on our approved rates and within the stipulated time limit without any extra claim for price escalation.

As when ask by the SBI, I/we shall submit the supporting technical data sheet, specification and make of the items as per the BOQ.

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We, hereby, also undertake that, we will not raise any claim for any escalation in the prices of any of the material during the currency of contract/execution/completion period.

Yours faithfully,

Signature of contractor
With Seal