

**The Oriental Insurance Company Ltd.
A-25/27,Asaf Ali Road,,
New Delhi -110002**

Tender Documents

NAME OF WORK: Repair, Replacement, Addition, Maintenance and Overhauling of Fire Fighting Systems / Equipments Installed at Following Offices of The Oriental Insurance Co. Ltd including yearly maintenance for three years of complete Fire Fighting System

AT

1. ORIENTAL HOUSE ,A-25/27 , ASAF ALI ROAD , NEW DELHI
2. The OIC Ltd Office, 88, Janpath, New Delhi
3. The OIC Ltd Office, Universal Bldg,2/2A , Asaf Ali Road , New Delhi.
4. The OIC Ltd Office, 4/14,Aggarwal House , Asaf Ali Road , New Delhi
5. The OIC Ltd Office, 1/16, Asaf Ali Road , New Delhi

Lead Consultants:

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PART –I

TECHNICAL BID

APPENDIX SHOWING IMPORTANT SCHEDULES

DESCRIPTION OF WORKS

1. Quotation Based on	Item Rate Tender.
2. Total tender amount	Rs 24,00,000/- (Rs Twenty Four Lacs only)
3. Cost of tender	Rs 1,000/- (Rs One Thousand only)
4. Sale of Tender	18 th June 2018 to 6 th July 2018
5. Pre Bid Meeting	29 th June 2018 at 11 AM
6. Submission of Tender	on or before 12 th July 2018 upto 2.50 PM
7. Date of commencement	Within 10 days of letter of award from the Employer.
8. Period of completion	75 Days (For Entire work)
9 . Liquidated Damages	Rs 5,000/- per day to the maximum of 10% of contract.
11. Period of final measurement	Within two months after completion.
12. Earnest money	Rs 48,000/- (Rs Forty Eight thousand only)
12. Value of interim certificate	Minimum Rs. Six Lacs
12. Retention amount	10% of the value of work done. Earnest money shall be adjusted towards retention money in end.
13. Refund of retention money	100% within 30 days of completion of defect liability period
14. Income tax deduction	As per prevailing rates from each bill.
15. Defects liability period	One year after virtual completion.
16. Period of honoring certificate.	Within Fifteen days after Architect's certificate issued for payment.

CONTENTS

TECHNICAL BID

SECTION		PAGE NO
I	Invitation to Tenderers	04- 09
II	Instructions to Tenderers	10- 11
III	General Conditions of Contract	12- 139
	CHAPTER –I	INTRODUCTION AND SCHEME
	CHAPTER-2	SYSTEM AND SYSTEM REQUIREMENTS
	CHAPTER-3	ARCHITECTURAL AND STRUCTURAL REQUIRMENTS
	CHAPTER-4	PLANNING, DESIGNING AND COORDINATION
	CHAPTER-5	FIRE PUMPS
	CHAPTER-7	PIPE WORK
	CHAPTER-8	FIRE FIGHTING ACCESSORIES
	CHAPTER-9	AUTOMATIC SPRINKLER SYSTEM
	CHAPTER-10	ELECTRICAL WORK
	CHAPTER-11	INSTALLATION, TESTING AND COMMISSIONING
	CHAPTER-12	ADDRESSABLE FIRE ALARM SYSTEM:
	CHAPTER-13	Make of Materials for Fire Fighting Works & Fire detection and Alarm system
IV	Special Conditions of Contract	140- 142

FINANCIAL BID (separately given)

SECTION

V	Schedule of Quantities
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SECTION - I INVITATION TO TENDERERS

- 1.1 Sealed tenders in two bid system are invited from established experienced contractors, having experience of repairs/ maintenance/ installations of Fire Fighting Systems, by the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd. A-25/27, Asaf Ali Road, New Delhi - 110 002.

S.No.	Name of Work	Estimated Value of Work (Rs.)	Time of Completion
1.	Repair, Replacement, Addition , Maintenance and Overhauling of Fire Fighting Systems / Equipments Intalled at Following Offices of The Oriental Insurance Co. Ltd including yearly maintenance for three years of complete Fire Fighting System At 1. ORIENTAL HOUSE ,A-25/27 , ASAF ALI ROAD , NEW DELHI 2. The OIC ltd Office, 88, Janpath, New Delhi 3. The OIC ltd Office, Universal Bldg,2/2A , Asaf Ali Road , New Delhi. 4. The OIC ltd Office, 4/14,Aggarwal House , Asaf Ali Road , New Delhi 5. The OIC ltd Office, 1/16, Asaf Ali Road , New Delhi	24 LACs.	75 days

- 2 Tenders are invited from reputed contractors for above work under two bids system (Technical & Financial) from eligible and experienced contractors with sound financial position.

- 3 The tender document containing terms and conditions including Financial Bid etc. can be obtained from our office **The Oriental Insurance Company Ltd, at A25/27, Asaf Ali Road, New Delhi-110002** during office hours (10.00 AM to 3.30 PM) on all working days between the dates given below

Sale of tender (Date) 18th June, 2018 to 6th July, 2018

Cost of tender Rs 1000/- (Non refundable)

The tender documents can also be downloaded from our website www.orientalinsurance.org.in or from <https://eprocure.gov.in/eprocure>. if downloaded from website then the contractor has to attach a demand draft for Rs 1000/ from a Scheduled Bank shall be paid in favour of "**The Oriental Insurance Co. Ltd., payable at New Delhi**" as cost of Tender documents along with EMD failing which tender will be rejected. The right is reserved by the officer inviting this tender to revise or amend the tender documents prior to the date notified for submission of the tender. Such revisions, amendments shall be notified in the form of addendum or corrigendum at company's Website. Bidders are advised to look at company's website regularly for any such corrigendum.

Pre-bid conference: There shall be a pre-bid conference at Chief Manager (Estate) office at The Oriental Insurance Company Ltd, A -25/27, Asaf Ali Road, New Delhi-110002 per the schedule, to obtain clarification if any from the client. The points, if any, emerged out from the discussion shall be published in our website and the same shall form part of the tender and subsequently the agreement. Only those contractors will be allowed to attend the pre-bid conference who have purchased the Tender Document .Those who have downloaded the tender documents shall submit the DD for the cost of tender document from a

Scheduled Bank shall be paid in favour of **“The Oriental Insurance Co. Ltd.” payable at New Delhi**, in the office of Chief Manager (Estate) prior to attending the pre bid meet.

- 3.1 Tenders are invited into two bid system i.e. **“Technical bid” and “Financial bid”**. The intending contractors should submit the following details in the technical bid duly contained in closed sealed **Envelope no. 1 superscribed as “Technical bid”**:
- a. Organizational setup
 - b. **Latest solvency for Rs 8.00 lacs** or more with any Scheduled Bank where the contractor is maintaining his account. The Certificate should not be more than 6 months old from last date of issue of tenders
 - c. Copy of Permanent account number (PAN)
 - d. **Annual Report (Balance sheet and Profit and Loss Account of last 3 Years** ending March 31 of previous financial year .The average annual turnover shall be at least 30% of total estimated cost
 - e. Copy of registration with Work Contract Tax department
 - f. The tenderer must satisfy themselves that they have adequate experience to handle this comprehensive multi-disciplinary project within the stipulated time schedule . They should produce documentary proof of satisfactory completing at least two jobs of similar nature, costing not less than Rs 12.0 lacs, each or three similar jobs of Rs 9.6 lacs each, or one job of similar nature costing not less than Rs 19.2 lacs, for Government, Semi-Government, Private/Public Sector organization in last seven years from the date of advertisement with complete details, name, address & phone nos. of clients etc. The similar nature works shall mean repairs/ maintenance/ installations of Fire Fighting Systems
 - g. Details of projects in hand with name of clients, addresses & phone nos.
 - h. Earnest money of **Rs 48,000/- (Rs Forty Eight Thousand Only)** In the form of Demand Draft from a nationalised bank in favour of **“The Oriental Insurance Co. Ltd.”**. payable at Delhi.
 - i. **For the tenders downloaded from website Rs 1000/- in the form of Demand Draft** from a Scheduled Bank shall be paid in favour of **“The Oriental Insurance Co. Ltd., payable at New Delhi**.

The Earnest Money will be refunded without any interest to all the unsuccessful tenders after the award of the work subject to the relevant provisions in the tender documents. Any false information furnished by the contractor shall lead to the forfeiture of the earnest money.

- 3.2 The “Financial bid” shall be contained in a closed sealed envelope no. 2 superscribed as **“financial bid”**. The financial bid shall contain **Section-V (Schedule of Quantities)** duly filled in by the intending tenderers. This shall form the part of the agreement.
- 3.3 Both the sealed envelopes of “Technical bid” and “financial bid” should be kept in **envelope no. 3** sealed and superscribed with the name of work on the top of

envelope shall be deposited in the office of the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd. A-25/27, Asaf Ali Road, New Delhi-110002, on or before 12.07.2018 before **14:50** hrs. The tender received in any manner other than prescribed above shall be summarily rejected. The company will not accept any responsibility for the tender lost in transit. The tender's are asked to visit, inspect / Carefully the site.

- 3.4 At first instance technical bid shall be opened on 12.07.2018, **15:00** hrs. The technical bid will then be evaluated on the basis of documents/information furnished as also if necessary, after physical examination of the tenders office/workshop & projects successfully executed by them. The criteria followed by the company will be at its sole discretion and will not be open to question. The contractors who shall qualify in the technical bid will only be eligible for the opening of their financial bid.
- 3.5 Date of commencement of the work shall be reckoned from the 10th day of award of work.
- 3.6 The work as detailed in this tender shall be executed and completed in all respects in accordance with the Tender documents, which includes instructions to tenderers, General conditions of contract, special conditions of contract, schedule of Quantities, list of approved materials and Drawings to complete satisfaction of the Architects and the Employer.
- 3.7 Rates must be quoted for complete work at site inclusive of all costs, taxes and charges etc. All taxes and duties including Sales Tax on work contract. ESI charges etc. as applicable at New Delhi/NCR on the date of receipt of tender, Central & State Sales Tax, Octroi, Royalties etc. on works and materials required for use in the execution of this project shall be entirely borne and payable by the Contractor and the Employer will not entertain any claim what so ever in this respect.
- 3.8 The tender for the works shall remain open for acceptance for a period of 90 days from the date of opening of tenders. If any tenderer withdraws his tender before the said period or makes any modifications in terms & conditions of the tender which are not acceptable by the company, then the company, shall without prejudice to any other right or remedy, be at liberty to forfeit 100% of the earnest money as aforesaid.
- 3.9 **Total Security Deposited during execution of work shall comprise of**
- (a) Earnest Money Deposit
 - (b) Retention Money
- 3.10 **Retention Money**
The retention money (i.e. deduction from interim & final bill shall be 10% of the gross value of each bill. The retention money & earnest money shall form the total security deposit during execution of work. The retention amount will be refunded to the contractor after the end of Defect Liability Period provided he has satisfactorily carried out all the works and attended to all defects in accordance with the condition of contract. No interest is allowed on retention money & earnest money. Earnest money shall be refunded after the submission and acceptance of final bill.
- 3.11 Earnest money of the successful tenderer is liable to be forfeited in the event of refusal or delay on his part in signing the agreement or starting the work as

mentioned in the tender and employer will be at liberty to award it to another contractor.

3.12 PERIOD of AMC

Three years from successful completion of one year warranty period with a provision to extend it further on mutually acceptable terms and conditions.

3.13 The competent authority on behalf of the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd. A-25/27, Asaf Ali Road, New Delhi-110002 reserves to himself the right of accepting the whole or part of the tender and the tenderer shall be bound to perform the same at the rate quoted.

3.14 Canvassing whether directly or indirectly in connection with the tender is strictly prohibited and the tenders submitted by the contractors who resort to canvassing in any form would be liable to rejection.

3.15 The tendering firms, in case the tenderer is a partnership firm, shall submit the tender signed by the partners. In the event of absence of any partner, it must be signed on his behalf by a person holding power of attorney which shall be attached along with the tender and it must also disclose that the contractor is duly registered under the Indian partnership Act or not.

3.16 The notice inviting tender shall form part of the contract document. The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority, shall within 10 days from the stipulated date of start of work sign the contract consisting of :

- a) The notice inviting tender, all the documents including additional conditions, invitation of tender and acceptance thereof together with any correspondence leading there to.
- b) Offer in standard tender form.

1.18 The tender shall unconditionally accept terms & conditions of the company. Conditional offer shall be summarily rejected.

CHIEF MANAGER (ESTABLISHMENT)
for **THE ORIENTAL INSURANCE CO. LTD.**
Asaf Ali Road, New Delhi-110002

STANDARD TENDER OFFER

THE ORIENTAL INSURANCE CO. LTD., ASAF ALI ROAD, NEW DELHI

Item Rate Tender & Contract for Works

Repair, Replacement, Addition , Maintenance and Overhauling of Fire Fighting Systems / Equipments Intalled at Following Offices of The Oriental Insurance Co. Ltd including yearly maintenance for three years of complete Fire Fighting System

AT

1. ORIENTAL HOUSE ,A-25/27 , ASAF ALI ROAD , NEW DELHI
2. The OIC ltd Office, 88, Janpath, New Delhi
3. The OIC ltd Office, Universal Bldg,2/2A , Asaf Ali Road , New Delhi. 4. The OIC ltd Office, 4/14,Aggarwal House , Asaf Ali Road , New Delhi
5. The OIC ltd Office, 1/16, Asaf Ali Road , New Delhi

To be submitted by between hrs. to hrs.

Issued to:

Signature of the person issuing the documents:

Designation:

Date of Issue:

TENDER

I/We have read and examined the notice inviting tender, Schedule, specifications applicable, Drawings & Designs, General rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Quantities & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi within the time specified in schedule, viz., schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in General Rules and Directions and the Conditions of contract and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

We agree to keep the tender open for Ninety days (90 days) from the due date of submission thereof and not to make any modifications in its terms and conditions.

A sum of Rs.48,000/- (Rupees forty eight thousand only) is hereby forwarded in the form of Demand Draft of a Nationalised Bank as earnest money. If I/we, fail to commence the work specified I/we agree that the said Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as will be ordered, upto maximum of the percentage 20% mentioned in the schedule and those in

excess of that limit at the prevailing Market rates/tendered rates whichever is lower of the two and shall be determined in accordance with the provision contained in the tender form.

I/We hereby declare that I/we shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/we am/are authorised to communicate the same or use the information in any manner prejudicial to the safety of The Oriental Insurance Company Ltd..

I/We agree that should I/we fail to commence the work specified in the above memorandum, an amount equal to the amount of the earnest money mentioned in the form of invitation of tender shall be absolutely forfeited to the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi and the same will at the option of the competent authority on behalf of the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi be recovered without prejudice to any other right or remedy available in law out of the deposit in so far as the same will extend in terms of the said bond and in the event of deficiency out of any other money due to me/us under this contract or otherwise.

Dated.....

Sign. of Contractor
Postal Address

Witness:
Address:

Occupation:

ACCEPTANCE

The above tender (as mentioned by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi for a sum of Rs.
(Rupees

.....)
.....)

The letters referred to below shall form part of this contract Agreement:

- a)
- b)
- c)

**for & on behalf of the Chief Manager (ESTABLISHMENT),
The Oriental Insurance Company Ltd.,
Asaf Ali Road, New Delhi.**

Dated Signature / Designation.....

SECTION-II: INSTRUCTION TO TENDERERS

- 2.1 The tender shall examine carefully all the tender documents consisting of:
TECHNICAL BID

Section - I	Invitation to Tenderers
Section - II	Instructions to Tenderers
Section - III	General Conditions of Contract
Section - IV	Special Conditions of Contract

FINANCIAL BID (separately given)

Section - V	Schedule of Quantities,
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These shall form part of the agreement.

The tenderer is advised to visit and inspect the site at his own cost and responsibility and to secure all necessary information which will be required for completing the tenderer. Ignorance of site conditions or local information shall not be considered as an excuse for non-performance of the contract. All costs, charges and expenses that will be incurred by the tenderer in connection with the preparation of his tender shall be borne by him and the Employer/Architect does not accept any liability whatsoever in this regard.

- 2.2 Time is the essence of the contract and the tenders are required to complete the work in all respects within the stipulated time of completion and hand over the same, complete in all respects to the satisfaction of the Architects/Employer.
- 2.3 The tender should contain not only the rates but also the value of each item of work entered in the prescribed column of the BOQ and all the items should be totaled up in order to show the aggregate value of the entire tender. The rates quoted by the tenderer should be expressed accurately both in words and figures so that there is not discrepancy. All corrections in the tender shall be duly attested by initials of the tenderers. Corrections if not attested, will entail rejection of tender. The rates quoted by the tenders in item rate tender will be the basis (and not the amounts in case of discrepancies) in finalising the tender.
- 2.4 It shall be clearly understood that the rates quoted in the tender are to be for complete work at site as per instructions to tenderers, conditions of contract, special conditions of contract specifications and drawings, addenda referred to therein and also for all such work's as are necessary for the proper completion of the contract. Although specific mention thereof will not have been made in the specifications or in drawings or in tender documents. The rates shall be firm and shall not be subject to cost escalation on account of labour and material and labour conditions or any other reason whatsoever.

- 2.5 The tenderer shall use only the form issued with this tender to fill up the rates.
- 2.6 Every page of the tender shall be signed on the bottom of right hand side and any tender not so completed is liable to be treated as defective and liable to be rejected.
- 2.7 The successful tenderer will be notified about the acceptance of his tender by the employer and he will execute agreement within 10 (ten) days thereof, failing which his tender would be liable to rejection with forfeiture of the Earnest Money and the employer would be at Liberty to award it to another tender.
- 2.8 The contract will be governed by the Indian Contract Act, Indian Sale of goods Act and all other relevant laws. All payments due to the contractor under the contract will be made in Indian Rupees Currency.
- 2.9 The rates quoted shall be for complete work at site and should be inclusive of incidentals expenses necessary for carrying out the work. The rates shall be inclusive of Sales Tax if applicable at New Delhi for or any other tax or duty levied by any Government or Public bodies. The rates shall be firm and shall not be subject to cost escalation of labour and material and exchange variations, labour conditions or any other conditions whatsoever.
- 2.10 A schedule of approximate quantities for various items accompanies this tender. It shall be clearly understood that neither the architect nor the employer accept any responsibility for the correctness or completeness of this schedule in respect of items and quantities and this schedule is liable to alterations by omission, deduction or additions at the discretion of the employer in consultation with the architect without violating the terms of the contract.
- 2.11 The employer does not bind itself to accept the lowest or any tender or to assign any reason thereof and also reserves the right of accepting the whole or part of the tender. The part acceptance will not violate the terms and conditions of the contract and will execute the work at the specified rates without any extra charges or compensation.
- 2.12 Tax deductions will be made as per the prevailing rates from the contractors on account bills.

SECTION III - GENERAL CONDITIONS OF THE CONTRACT

CHAPTER –I

3.1.0 INTRODUCTION AND SCHEME

a) Name of Work

Repair, Replacement, Addition , Maintenance and Overhauling of Fire Fighting Systems / Equipments Intalled at Following Offices of The Oriental Insurance Co. Ltd including yearly maintenance for three years of complete Fire Fighting System

AT

1. ORIENTAL HOUSE ,A-25/27 , ASAF ALI ROAD , NEW DELHI
2. The OIC ltd Office, 88, Janpath, New Delhi
3. The OIC ltd Office, Universal Bldg,2/2A , Asaf Ali Road , New Delhi. 4. The OIC ltd Office, 4/14,Aggarwal House , Asaf Ali Road , New Delhi
5. The OIC ltd Office, 1/16, Asaf Ali Road , New Delhi

b) SCOPE OF WORK

Following work are to be executed under this tender:-

(i) REPAIR AND MAINTENANCE OF EXISTING FIRE FIGHTING SYSTEM (WITH SPRINKLERS SYSTEM in basement) AND SUPPLLYING AND INSTALLATION OF NEW ITEMS INCLUDING YEARLY MAINTENANCE FOR THREE YEARS OF COMPLETE FIRE FIGHTING SYSTEM

c) SCHEME

(i)Fire Fighting System: -

Terrace pumps will be installed at the terrace of the building.

1 No Yard hydrant will be provided at suitable location. There are
2 Nos down comer Vertical Shafts in the building. Internal Hydrants with first Aid Hose Reels will be provided at each floor from Basement to Terrace Floors. Air vessel shall be provided at the Terrace. The Terrace Tank will feed the down comer at the Terrace.

Sprinkler will be provided in basement and connected to the same fire pump.

In Sub-Station, DG sets are being provided. The Terrace tank fire pump will be connected with DG set supply. The Electric panels have been proposed separate for terrace pumps (Essential).

A Fire Control Room is being provided at ground Floor. In order to monitor the status of entire systems an indication panel for Fire Fighting pumps. is proposed to be installed in the Fire control room.

(d) Fire Extinguishers: - Fire Extinguishers of following types are proposed in the building at suitable locations.

- a) CO2 type 4.5kg & 6.5Kg. capacity conforming to IS: 15683
- b) Water Co2 Type 9 ltrs capacity conforming to IS: 15683.
- c) Dry Chemical Powder type of 5 Kg. conforming to IS: 15683.
- d) ABC type of 5kg & 10 Kg. conforming to IS: 15683.
- e) D type of 5 Kg. conforming to IS:15683.
- f) Clean Agent Halotron based Ceiling Mounted Fire Extinguishers (Modular Thermatic Type for Transformer Room & DG Area)

2kg & 4kg capacity Clean Agent Halotron based Firespot Automatic suppression system (for Electrical panel)

3.1.1 DIRECTIONS REGARDING PROCEDURES

In construing these conditions, specifications and Contract Agreement, the following words shall have the meaning here in assigned to them except where the subject or context otherwise requires:

- (a) "Employer" Shall mean The Oriental Insurance Co. Ltd having its Office at A-25/27, Oriental House, Asaf Ali Road ,New delhi-1 and shall include its authorized representative/s, assign/s and successor/s
- (b) "Contractor/Builder" Shall mean the individual or firm or company, whether incorporated or not, undertaking the work and shall include legal personal representatives of such individual or the persons comprising such firm or company or the successors of such individual or firm or company and the

permitted assignee of such individual or such individual or firm or company.

- (c) "Architect" Shall mean the said whose registered office is situated at Ms Vastu Mandal, Architects and Interior Designers, F-328 Lado Sarai, New Delhi-110030 (and shall include his authorised representative) or in the event of his death or termination of his services by the Employer in his sole and unqualified discretion, such other person/persons as shall be provided always that no person subsequently appointed to be Architect under this contract shall be entitled to disregard or over rule any previous decision or direction given or expressed by the Architect specified here in unless otherwise approved by the Employer.
- (d) "Project Manager" Shall mean the accredited representative of the Employer and shall be over all in-charge of the work. He shall administer the contract as per contract Agreement conditions.
- (e) "Contract" Means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Chief Manager (ESTABLISHMENT), The Oriental Insurance Company Ltd., Asaf Ali Road, New Delhi and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.

In the contract, the following expressions shall, unless the context otherwise requires have the meanings, hereby respectively assigned to them:

- (i) The expression **works** or **work** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.
- (ii) The **site** shall mean the land/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which

will be allotted or used for the purpose of carrying out the contract.

- (iii) **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s).
- (iv) **Tendered Value** means the value of the entire work as stipulated in the letter of award of work.

3.1.2 General

The work shall be carried out strictly in accordance with the drawings amplified by the specifications of materials and workmanship given hereunder. The drawings and specifications shall be taken together and shall complement each other. In case of any discrepancy, the following order of preference shall be followed:

- (a) Particular Specifications.
- (b) Drawings.
- (c) CPWD Specifications & Latest DSR on date of Publication of the tender.
- (d) National Building Code and Relevant IS Provisions.

In case there are no specifications for items shown on the drawings or where items are not exhaustively described, the general specifications of CPWD shall be followed for which nothing extra shall be paid. However the specification should be got approved from the Architect before commencement of work.

3.1.3 Drawings and Specifications

a) Tender / Working Drawings

b) Drawings for approval on award of the work

The contractor shall prepare and submit following drawings and get them approved from the Engineer-in-charge before the start of the work. The approval of drawings however does not absolve the contractor of his responsibility to supply the equipments/materials as per agreement. In case of any contradiction between the approved drawings and agreement the decision of the Engineer-in-Charge shall be final and binding on the contractor.

- (i)Any drawings relevant to the work. (Optional if needed)

c) Completion Drawings

Three sets of the following laminated drawings shall be submitted by the contractor while handing over the installation to the Department. Out of

this one of the sets shall be laminated on a hard base for display in the fire control room. In addition one set will be given on compact disc.

- (i) Line diagram and layout of all electrical control panels giving switchgear ratings and their disposition, cable feeder sizes and their layout,
- (ii) Control wiring drawings with all control components and sequence of operations to explain the operations of control circuits.

d) DOCUMENTS TO BE FURNISHED ON COMPLETION OF INSTALLATION

Three sets of the following documents shall be furnished to the department by the contractor on completion of work:-

- (i) Completion drawings as per para 3.1.3 (c)
 - (ii) 3 sets of manufacture's technical catalogues of all equipments all accessories.
 - (iii) Operation and maintenance manual of all major equipments, detailing all adjustments, operation and maintenance procedure.
- (a) After signing the Contract, the contractor will be given free of charge three prints of all working drawings. The contractor shall make at his own expense any additional copies he requires. One copy of the drawing furnished to the contractor as aforesaid shall be kept by the contractor at site and the same shall, at all reasonable times be available for inspection and use by the Architect and his representatives any by any other person authorized by him in writing.
 - (b) Such further drawings and instructions including revisions, as the Architect will furnish to the Contractor shall from part of this contract.
 - (c) Only figured dimensions and detailed drawings shall be followed. The Contractor shall verify all dimensions in the field before any work is started and obtain instructions of the Architect in case of any discrepancy.
 - (d) The Architect with approval of the project manager shall have power and authority to supply to the Contractor from time to time during the progress of the work, such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of work and the Contractor shall carry out and be bound by the same.

3.1.4 Architects Status and Decisions

- (a) Status:

The Architects shall have general supervision and direction of the work. He has authority on behalf of the Employer to stop the work whenever such stoppage will be necessary to ensure the proper execution of the work. The architect shall be the interpreter of the conditions of contract and the judge of its performance subject to the approval of the Project Manager.

(b) Decisions:

The Architect shall, within a reasonable time, make decisions on all claims of the contractor and on all other matter relating to the execution & progress of the work or the interpretation of the contract documents. The decisions, opinion direction of the Architect with respect to all or any of the following matters shall be referred to the Project Manager and decision so taken shall be final & binding to the contractor.

- i) Variation or modifications of the design.
- ii) The quality or quantity of works or the additions/alterations or omissions or substitutions of any work.
- iii) Any discrepancy in the drawings or between the drawings and or specifications.
- iv) The removal and / or re-execution of any work by the contractor.
- v) The dismissal from the work of any persons employed therein.
- vi) The opening up for inspection of any work covered up.
- vii) The amending the making good of any defects under defects liability period.
- viii) Approval of materials and workmanship.
- ix) The contractor to provide every thing necessary for the proper execution of the work.

(c) The authorities so conferred in the architect vide various clause above shall be subject to review of the Project Manager at any time whenever desired his decision shall binding under the contract.

(d) The employer shall be at liberty to take over the project at any time get the work executed directly under the supervision of Project Manager. The power vested in the Architect under this tender shall automatically be vested in the Project Manager thereafter.

(e) In the event of any dispute under this contract or between the Architect & the contractor, the speedier decision will be final in the matter. In case the contractor refer the matter to the Project Manager for speedier decision.

(f) Dismissal:

The contractor shall on the report of the architects immediately dismiss from the works within 24 hours any person employed thereof by him, who will, in the opinion of Architects be incompetent or misconducts himself and such person shall not be re-employed on the works without the permission of the Architects.

3.2.1 Extent of Contract

The contractor shall supply at his own cost all material implements, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not and which will be necessary for the purpose of satisfying of conditions he is entitled to be satisfied which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply survey instruments and other materials necessary for the purpose of setting out works, and counting weighing and assisting to the measurement or examinations at the any time and from time to time of the work material, failing his so doing the same will be provided by the engineer-in-charge at the expense of the contractor and the expenses will be deducted from any money due to the contractor under the contract from his security deposit or the proceeds of sale thereof. The contractor shall also provide a sufficient portion of fencing and lights required to protect the public from accident, and shall be bound to bear the expenses of defense brought by any person for injury sustained owing to neglect of the above precautions and to pay any damage and costs which will be awarded in any such suit, action or proceedings to any such person or which will with the consent of the contractor be paid to compromise any claim by any such person. In no case, the employer shall be as a party to any such claim/claims and the contractor shall indemnify the employer against any claim for any person on this account.

3.2.2 Sufficiency of Tender

The contractor shall be deemed to have satisfied himself before tendering to the correctness and sufficiency of his tender for the work and of his prices for the work and of his prices stated in the schedule, which shall, except in so far as it is otherwise provided in the contract, cover all his obligations under the contract and all matters and things necessary for the proper completion and maintenance of the work.

3.2.3 Assignment or Sub Letting of Contract

The contractor shall not assign the contract or any part thereof or any benefit or interest therein or there under or any claim arising out of the contract to any other party without the prior written consent of the employer.

3.2.4 Power to make Alterations

Architect shall have power to make any alterations or additions to the stipulated specifications, drawings, designs, and in striations that may appeal to him to be necessary or, advisable during the progress of the work and the contractor shall have no claim for compensation on account of such alterations or additions. The contractor shall be bound to carry out the work in accordance with any instructions which will be given to him in writing signed by the Architect and such alterations shall not invalidate the contract and any additional work which the contractor will be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work and at the same rates as are specified in the tender for the main work. The time for the completion of the work shall be extended in the proportion that the additional work bears to the original contract work and the certificate of the Architect/Project Manager shall be conclusive as to such proportions.

3.3.0 WORKS SUBJECT TO APPROVAL OF ARCHITECT

All works to be executed under the contract shall be subject to approval of the architect who shall be entitled to direct at what point or points and in what manner they are to be commenced and from time to time carried on.

3.3.1 Contractors office and Stores

All offices, sheds and stores required by the contractor shall be enacted at his own cost with the prior approval of the Project Manager or his representative and shall be dismantled and removed upon the completion of the work if so directed within 7 (seven) days of the issue of such intimation.

3.3.2 Urgent Repairs and Urgent works

If by reason of any accident or failure or other event occurring to or in connection with the work or any part thereof either during the execution of the work or during the period of Guarantee, any remedial or other work or repair shall in the opinion of Project Manager be urgently necessary for security and the contractor is unable or unwillingly at once to do such work or repair, the employer will on its own get the work done/remedied/repared as the Resident Engineer will consider necessary. If the work or repair so done by the employer is such, which, in the opinion of the Architect the contractor was liable to do at his own expense under the contract, all costs and changes incurred by the employer in doing so shall on demand be paid by the contractor to the employer or will be deducted by the employer from any money due or which will become due to the contract. Provided always that the resident engineer shall soon after the occurrence of any such emergency as will be reasonable notify the contractor thereof in writing.

3.4.0 DIRECTION FOR EXECUTION OF WORK

3.4.1 Setting outs

The contractor shall be responsible for the true and proper setting out of the works in relation to the original points, lines and levels of reference given by the architect

in writing and for correctness subject as above mentioned of all the positions, levels dimensions and alignments of all parts of the work and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the work any error shall appear or arises in any part of the work, the contractor on being required to do so by the Project Manager shall at once inform the architect or their representatives. The checking of the work by the architect/representative shall not in any way relieve the contractor from his responsibilities of carrying out the work as per the best practises of construction.

3.4.2 Work to be to the satisfaction of the Architect

The contractor shall execute, complete and guarantee the work in accordance with the contract to the satisfaction of the architect and shall comply with the adhere to their instructions & directions concerning the work.

3.4.3 Engagement of Labour

The contractor shall employ labour in sufficient numbers either directly or through subcontractors, where such sub letting is permitted to maintain the required rate of specified in the contract and to the satisfaction of the architect. The contractor shall not employ in connection with the works any person who has not completed his fifteen years of age.

The contractor shall comply with the provisions of the payment of Wages Act, 1936; Minimum Wages Act, 1948; Act, 1947; Maternity Benefit Act, 1961 and Mines Act, 1938, Labour Contract (Regulations & Abolishing) Act or Rules, or any modifications thereof or any other law relating thereto and rules made there under time to time.

The contractor shall indemnify the employer against any payment to be made under and for observance of the Regulation aforesaid without prejudice to his right to claim indemnify from his sub-contractors.

The contractor shall provide and maintain at his own expenses all rights, guards, fencing and watching when and where necessary or required by the Resident Engineer for the protection of the works or for the safety and convenience of those employed on works or the public.

3.4.4 Disruption of Progress

The contractor shall give written notice to the Architect whenever planning or progress of the works is likely to be delayed or disrupted unless any further drawings or order, including a direction, instruction or approval is issued by the Architect within a reasonable time. The notice shall include details of the drawing or order required and by when if is required and of any delay or disruption likely to be suffered if it is late.

If, by reason of any failure or inability of the Architect to issue within a time reasonable in all the circumstances any drawings or order requested by the contractor and the work suffers delay then the architects shall take such delay into

account in determining any extension of time to which the contractor is entitled under provisions of contract hereof, however no other compensation will be admissible on this account.

3.4.5 Rectification of Defects

if, it shall appear to the Architect or his representative in-charge of the works that any work any has been executed with unsound, imperfect or un-skillful workmanship or material or any inferior description, the contractor shall, on demand, in writing from the Architect specifying the work material or articles complained of shall rectify or remove and reconstruction work so specified in part, as the case will require.

3.4.6 Variation

In case the quantity of any item of the work executed increases by more than 25% from the quantity given in the tender document, the rate of such item would be settled as under:

- a) Rate of the item worked out as per Market rate
- b) Rate of the item quoted by the contractor.

The rate of such item would be lower of the two rates mentioned above.

3.4.7 The contractor shall submit the samples of various material for the approval of the Architect & Client. The contractor shall use the material only after the approval of the Architect/Client. The verification of the material shall be done on random base during the progress of the work in either the following manner :

- (a) Random samples would be picked up during execution of work from site & if decided by the Architect/client, it would be sent to one of the approved laboratories for test & quality check. The cost of such tests would be borne by the client.
- (b) The Architect/client will direct the contractor to submit the challan of delivery of the material brought at site. It would be on Random based. The Architect will also direct the contractor to submit the copy of the test/verification certificate provided by the manufacturer of that particular material.

3.4.8 Free Access to work site

The contractor shall provide all necessary and reasonable facilities and free access to the works and his records at site of work to the Architects, Resident Engineer and their representatives. He shall provide facilities and space to the satisfaction of the Architect or his representative for inspection of any part of work.

3.4.9 Inspection of work

All work under or in course of execution or executed in pursuance of the contract shall at all times be open to inspection and supervision of the Architect or his

representative and the contractor shall at all times with reasonable notice or the intention of the Architect or his representatives to visit work shall have been given to the contractor, either himself be present to receive orders and instructions, or have responsible agent duly accredited in writing present for that purpose. Orders to the contractor's agent shall be given to the contractor himself.

3.4.10 Preparation of Implementation Programme Schedule

As and when sufficient planning information is available, the contractor in consultation with the Architect shall prepare a programme of the activities. Contractor should prepare bar-charts & articles path method analysis of the light of the tendered quantities and their rates respectively. Under no circumstances shall this schedule be prepared later than one week of finalisation of contract. Throughout the work, all programmes, schedules and charts shall be revised wherever any significant change occurs. The contractor shall also submit weekly progress chart to the Architect.

3.4.11 Site Order Book

The contractor shall maintain a Site Order Book at the site of the works wherein the instructions of the Architect/Project Manager or their representatives shall be reasoned. The site order book shall be the property of the employer and the instructions recorded therein shall be deemed to have the same force and effect as if they had been given to the contractor himself. The contractor or his representative on the site must sign the book in taken of his having persuade the orders given therein.

3.4.12 Hindrance Register

A Hindrance Register shall be maintained at the site of work wherein the contractor shall notify the items affected and the execution of work, the date on which the delay was cleared. These entries shall be initiated by the Project Manager/Architect as well.

3.4.13 Suspension of Work

The contractor shall on the written order of Project Manager on written recommendation of the architect suspend the progress of the work or any part thereof for such time or time and in such a manner as the Project Manager will consider necessary and shall during such suspension properly protect and secure the work as considered necessary in the opinion of the Project Manager or their representative-in-charge of the work. No compensation shall be payable to the contractor on what so ever account for the suspension of work.

3.4.14 Extension of time for completion

If the contractor shall desire an extension of the time for completion of the work, on his having been unavoidably hindered in its execution or on any other ground, he shall apply in writing to the architect within three days of the date of starting of the hindrance on account of which he desires such extension as aforesaid. The architect in consultation with employer shall, if, in his opinion, will authorise, such extension of time, if any, as will in his opinion be necessary or proper extension granted shall be without prejudice to the right of the Employer to recover compensation for delay as per **provisions of Para 3.4.15**

3.4.15 Liquidated Damages for Delay

The times and date stipulated in the contract for the completion of the work or any part or stage thereof shall be deemed to be the essence of the contract.

The work shall, throughout the stipulated period of the contract, be carried out with all diligence. If the contractor fails to complete the work within the time prescribed or within the extended time under the contract, he shall pay to the Employer on demand amount without prejudice to other rights and remedies the Employer will have against the contractor, a sum of Rs. 5000/- per day as liquidated damages for such fault, if the work remain unfinished after the stipulated date of completion provided that the total liquidated damages payable shall not exceed 10% of the accepted contract price. The Employer will, without prejudice to any other method of recovery, deduct the amount of such damages from any money due or which become due to the contractor. The recovery or deduction of such damages shall not relieve the contractor from any obligations and liabilities under the contract.

3.4.16 Defects Liability Period

The contractor shall be responsible to make good and remedy at his own expense within such period as will be stipulated by the employer any defect which will develop or will be noticed before the expiry of 12 (twelve) months from the date of completion and intimation of which has been sent to the contractor within seven days of the expiry of the said period.

If the contractor or his work people, or servants shall break, deface, injure, or destroy any part of a building, or interiors, then the contractor has to rectify the same part at his own expenses to the satisfaction of the Architect.

3.4.17 Approval of Materials

The contractor would bring samples of necessary materials per the directions & would get them approved prior to execution of work.

3.5.0 SECURITY DEPOSIT

3.5.1 Rate of Security Deposit (Retention Money)

The employer will, at the time of making any payment to the contractor for work done or supply made under the contract deduct 10% of Gross value of each interim bill. The maximum amount of Retention money + Earnest Money shall amount to total Security Deposit.

All compensations or other sums of money payable by the contractor to the employer in terms of this contract will be deducted from, or paid by, the sale of a sufficient part of his security deposit, or from any sums which will become due to the contractor by the employer on any account whatsoever, and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall within ten days. Thereafter make good in demand draft, endorsed in favour of the employer as aforesaid any sum or sums which will have been deducted from, or raised by sale of his security deposit or any part thereof.

3.5.2 Forfeiture of Security Deposit

The above said security deposit shall be liable to forfeiture wholly or in part at the sole discretion of the Employer if the contractor fails to carry out the work or perform or observe any of the conditions of the contract.

3.5.3 Interest on the Security Deposit

No interest would be payable by the employer to the contractor on the security held in deposit.

3.5.4 Responsibilities for the Structural Adequacy

The contractor shall comply with the provisions of the contract and with due cares and diligence, execute and maintain the work and provide all labour, including supervision of all works, structural plans and other things whether of temporary or permanent nature required for such execution and maintenance in so far as the necessary for providing these, is specified or is reasonably inferred from the contract. The contractor shall take full responsibilities for the adequacy, suitability and safety at site of all the works and methods of the construction provided.

3.6.0 MEASUREMENT AND PAYMENTS

3.6.1 All bills supported with measurement details shall be submitted by the contractor fortnightly to the Architect for all works executed in the previous period and the Architect/Project Manager or his representative shall verify the requisite measurement for the purpose of having the same verified for the claim as far as admissible, if possible before the expiry of 15 days from the presentation of the bill.

All measurements to be taken in duplicate and all bills shall be submitted in triplicate along with a contractor's copy of each.

3.6.2 Final Bill

Final bill supported with consolidated measurement of the full work executed shall be submitted by the contractor within 1 month of completion of work.

When the final bill has been verified and corrected, the architect will give seven days notice to the contractor to countersign the bill in token of acceptance, the contractor shall countersign the bill within the above seven days or intimate in writing his intention to dispute. If the contractor fail to take appropriate action as above within the period prescribed, the bill finalised by the architect or his representative shall be final and binding on the contractor and the contractor shall have no right to dispute the same.

3.6.3 Claim for Interest

No claim for interest will be entertained by the Employer with respect to any moneys or balances which will be in its hands owing to a dispute between itself and the contractor or with respect of any delay on the part of the employer in making interim or final payments or otherwise.

3.6.4 Rates for extra Additional, Altered or Substituted work

The rates for additional, altered or substituted work shall be worked out in accordance with the following provisions in their respective order.

- i) If the rates for similar additional, altered or substituted work and directly available in the contract for the work, the contractor is bound to carry out the work at the same rates as are available in the contract for the work.
- ii) If the rates for additional, altered or substituted work are not directly available in the contract for the work the rates will be derived from the rates for a similar class of work as are specified in the contract for the work.
- iii) If the rates for the altered, additional or substituted work cannot be determined in the manner specified in sub-clause (i) to (ii) above, then the contractor shall within three days of the date of receipt of order to carry out the work, inform the Architect of the rate which it is intended to charge for such works supported by analysis of the rate or rates claimed. Rates finalised and approved by the Architect on the basis of these details will be final and binding. However, the architect by notice in writing will be at liberty to cancel his order to execute such work and arrange to carry it out in such a manner as he will deem advisable, but under no circumstances shall the

contractor suspend the work once ordered in writing on the plea of non-settlement of rate.

3.6.5 Reimbursement of Variation in Price

Prices and rates quoted by the bidders shall be considered as firm for the complete work and entire duration of the contract. No claim for extra payment due to any rise in rates of raw material and labour or due to whatsoever reasons, shall be considered, not even for extended period of completion.

3.7.0 GUARANTEES

3.7.1 Quality of Work

The contractor shall guarantee that the materials and workmanship are the best of their respective kinds for the service intended and that all items of work will be free from all inherent defects in workmanship and materials. He shall also guarantee that the works will not fail in any respect due to quality of materials, workmanship and methods of construction.

The specifications assume a proper degree of skill on the part of contractor and workmen employed. The contractor shall consult the Architect or his representative, whenever in his judgment variation in the methods of construction or in the quality of material would be beneficial or necessary to fulfill the guarantee called for. Such variations will be made by the contractor only when authorised by the architect.

3.7.2 Rejection

If during the "Period of Guarantee", as defined under clause 3.7.6 hereof, any work or material shall fail in any respect to meet the above guarantee, the contractor shall replace such work or material in a condition which will meet the above guarantee, immediately.

3.7.3 Cost of Execution of work or repair etc.

All work of repair shall be carried out by the contractor at his own expense if the necessity thereof shall in the opinion of the Architect be due to the use of materials or workmanship not in accordance with the contract or on account of neglect or failure on the part of the contractor to comply with any obligation expressed or implied on the contractor's part under the contract.

3.7.4 Remedy on Contractor's failure to carry out the work required

If the contractor shall fail to do any such work as aforesaid required by the architect the employer shall be entitled to carry out such work which

the contractor should have carried out, at the contractor's own cost. The employer shall be entitled to recover from the contractor the cost thereof or will deduct the same from any money due or that will be come due to the contractor.

3.7.5 Certificate of completion of works

On completion of the work, the contractor shall be furnished with a certificate, but not such certificate be given nor shall the work be considered to complete until the contractor shall have removed from the area of the premises (to be distinctly Marked by the Architect/Project Manager in the site plan which, the work shall be executed) all scaffolding, surplus materials and rubbish and clean the dirt from all wood work, doors, windows, walls, floors or other parts of any building, in or upon which the work is to be executed, or of which he will have had in possession for the purpose of the execution hereof. If the contractor shall fail to comply with the requirements of the clause as to the removal of scaffolding, surplus materials and rubbish and cleaning off dirt on or before the date fixed for the completion of the work, the architect will at the expense of the contractor remove such scaffolding, surplus materials, and the contractor shall forthwith pay the amount of all expense so incurred, and shall have no claim in respect of any such scaffolding or surplus materials aforesaid, except for any sum actually realized by the sale thereof.

3.7.6 Period of Guarantee for Complete work

The period of Guarantee for the works shall be **one year** starting from the date of issue of the completion certificate.

3.7.7 Contract Valid during Guarantee Period

This contract shall remain valid and in force until the expiry of Guarantee period year from the date of issue of virtual completion certificate and thereafter AMC for a period three years from successfully completion of one year warranty period with a provision to extend it further on mutually acceptable terms and conditions

3.8.0 CONTRACT DURING AMC PERIOD

a) Period of AMC

Three years from successfully completion of one year defect liability period with a provision to extend it further on mutually acceptable terms and conditions

b) Terms of Payment

The quoted rates of the AMC should be inclusive of all taxes, TA/DA Payment shall be made in four quarterly installments every year on the having successful performance report on quarterly basis of the AMC value

at the end of each quarter. Successful tenderers shall deposit the security deposit equal to 10% of total value of contract for one year, in full at the commencement of the contract else if, so desired the same shall be deducted from the 1st installment. The security shall be released after successful completion of contract period

c) AMC Conditions

- i) The contractor shall be responsible for Yearly Maintenance of existing fire fighting system including refilling of fire extinguishers as required and complete hydraulic test for internal hydrants, sprinkler system and Automation of fire pumps, Detection System, Alarms etc. complete fire fighting and detection system up to three years complete in all respects. The term "Maintenance" shall also include oiling, cleaning, greasing, servicing repair of any or all the parts during the currency of the contract at the exclusive risk, responsibility and the cost of the contractor (Excluding the material cost of already existing Items at the time of award of contract which are not supplied by the contractor)
- ii) In addition the contractor shall carryout comprehensive quarterly inspection by the competent person for preventive maintenance and shall submit to the company the tabulated assessment report of same.

The contractor ensures that all the equipments included in the service contract are in working condition at all the times.

- iii) The contractor shall have a telephone in his office/repair depot and at his residence for receiving complaints round the clock. The complaints shall be attended to within 12 hours of receiving the complaints
- iv) However, The Oriental Insurance Company Ltd reserves the right to abandon or terminate the contract at any time, if successful tenderer's work and maintenance services are not found satisfactory.

3.9.0 RESCINDING/TERMINATE CONTRACT

3.9.1 Rescinding Contract

In any case in which under any clause or clauses of this contract the contractor has rendered himself liable to pay compensation amounting to the whole of his security deposit in hand of employer (whether paid in one sum or deduced by installments) the architect on behalf of the employer shall have power to adopt any of the following course, as deemed best suited to the interests of employer.

- (a) To rescind the contract (of which rescission notice in writing to the contractor under hand of the architect shall be conclusive evidence), and in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the employer.
- (b) To employ a contractor paid by the employer and to supply materials to carry out the work, or any part of the work, debiting the contractor with the cost of the labour and the price of the materials (of the amount of which cost and price certificate of 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 rates as if it has been carried out by the contractor under the terms of the contract. The certificate of the architect as to the value of the work done shall be final and conclusive against the contractor.
- (c) To measure up the work of the contractor, and to take such part of the work of the contractor as shall be unexecuted out of his hands, and to give it to another contractor to complete in which case any expenses which will be incurred in excess of the sum which would have been paid to the original contractor if the whole work has been executed by him (of the amount of which excess certificate in writing of the architect shall be final and conclusive) shall be borne and paid by the original contractor and will be deducted from any money due to him by employer under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or a sufficient part thereof.
- (d) In the event of any of the above courses being adopted by the architect, the contractor will have no claim to compensation to any loss sustained by him by reason of his having purchased any materials, or entered into any engagements made any advances on account of execution of the work or performance of the contract. And in case of the provisions aforesaid, the contractor shall not be entitled to be paid for any work actually performed under this contract unless and until the architect shall have certified in writing the performance of such work and the value payable in respect and he shall only be entitled to be paid the value so certified.

3.9.2 Termination of the Contract

If at any time after the commencement of the work the employer for any reason whatsoever does not require the whole or part thereof as specified in the tender to be carried out, Architect/ Project Manager shall give notice in writing of the fact to the contractor who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage, which would have derived from the execution of the work in full, but which he did not derive in consequences the full amount of the work not having been carried out, neither shall he have any claim nor compensation by reason of any alterations having been made in the

original specification, or the designs and instruction on which shall involve any containment of the work originally contemplated.

3.9.3 Jurisdiction

The contractor and its operation shall be governed by the law of India for the time being in force, irrespective of the place of delivery of materials the place of execution of work or place of payment under this contract shall be deemed to have been entered into at New Delhi.

3.9.4 Bye Laws of Local Authorities

The contractor shall conform to the provisions of any Government Acts which relate to works and to the regulations and bye laws of any local authorities. The contractor shall give all such notices required by the said Act or Laws, etc., and pay all fees payable to such authorities and allow for these contingencies in his tendered rates including fees for encroachment, stacking charges, costs of restorations, etc., and all other fees payable to the local authorities. The contractor shall keep the employer indemnified against all penalties and liabilities for every hand of breach of any such Act, Rules, Regulations or Bye-laws.

Contractor shall comply with all laws and statutory regulations dealing with the employment of labour such as:

- a. The payment of wages Act, 1936
- b. The Minimum Wages Act, 1938
- c. The Workmen Compensation Act, 1923
- d. The Contract Labour (Regulations & Abolishing) Act.
- e. The employer's liabilities Act, 1938
- f. Industrial Dispute Act, 1938
- g. Maternity Benefit Act, 1961
- h. The Employees State Insurance Act, 1948

Safety code, labour welfare Act or rules or any modification thereof any other laws and regulations framed by the Competent Legislative Authorities from time to time.

CHAPTER-2

SYSTEM AND SYSTEM REQUIREMENTS

2.1 INTRODUCTION

Fire safety in building has become very important consideration in construction and maintenance. A normal office building has fire load in the form of large quantity of papers and furnishing. Buildings like Office Building, Laboratories, Auditorium, Libraries, Museum etc. require fire provisions by virtue of type of occupancy and importance irrespective of their height.

The aim of fire safety measure is to provide protection to life of occupants and property in the event of fire in the building. National Building code of India part-IV deals in details measures to be adopted for fire safety in buildings. The measures depend upon the occupancy, use, height and area of building.

Besides various medium of a fire, water is the cheapest and the most easily available for this purpose. Water based fixed fire fighting installations are most commonly provided in buildings.

The design and installation of a fire fighting system is of at most importance. The fire fighting installation on completion will have to be got cleared from the local fire fighting authorities (fire service) for its efficacy, suitability and usability by the fire Service in the event of a fire.

Accordingly such system shall be executed on turnkey basis to ensure proper quality of material and zero leakage systems apart from use of equipment and other accessories. All the components shall be integrated to ensure proper performance at the time of fire.

2.2 FIRE FIGHTING SYSTEM:

2.2.1 Following types of water based fixed fire fighting installations are normally provided in buildings.

- i. Wet Riser.
- ii. Down Comer.
- iii. Wet Riser cum Down Comer.
- iv. Automatic Sprinkler.

2.2.2 In all the above system, lines are laid in and/or around the building and permanently charged with water from a pressurized supply. In a building any one system or a combination will be provided depending upon application of guidelines laid down in National Building code of India (Part-IV) as amended up to date.

2.2.3 Requirement of fire fighting Installation in various buildings has been indicated in Appendix 'A'. however while selecting system for a building, provision of para 2.2.2 shall also be taken into consideration. However this being existing building not every thing will be possible to implement as mentioned above.

2.3 SYSTEM COMPONENTS.

Besides architectural and building provisions such as underground tank, pump houses, pump houses, terrace tank, shafts for installation of internal hydrants, etc. fire fighting systems shall Generally comprise supply, installation, testing and commissioning of components as detailed in table.

2.4 SYSTEM ENGINEERING:

The capacities and sizes of various components described above will depend upon the type and height of the building. Specification of various components have been described in succeeding chapters. Followings factors shall be taken in to consideration while designing various components.

2.4.1 Down Comer:-

2.4.1.1 The operating pressure of individual hydrant shall be 3.5 kg/cm². At terrace level hydrant, minimum 3.5 kg/cm² pressure shall be maintained.

2.4.1.2 The pipe line will be designed in such a way that it should be possible to get discharge at any location. Design parameters shall be as under:-

- (i) Maximum flow velocity - 2.5 mps.
- (ii) Maximum Friction - 5 m. per 100 m. run

2.4.1.3 Main Fire Pumps (Both electrical as well as diesel shall be selected for.

- (i) Discharge - 900 lpm/450 lpm. (To be selected from Appendix 'A')
- (ii) Head
 - 35 m + Height of terrace level hydrant above pump Level
 - + 6% of maximum length of pipe from pump discharge to any hydrant at terrace level.

2.4.1.4 Terrace pump shall be selected for

- (i) Discharge - 450 lpm
- (ii) Head - 20 m. + 6% of the maximum length of pipe from terrace Pump to any hydrant at terrace level.

2.4.1.5 No. of Down Comers:- Number of down comers will be decided to fulfill the following condition:-

- (i) No corner of the building is farther than 30 m. from nearest riser.
- (ii) The horizontal distance between two downcomers shall not be more than 50 m.
- (iii) Normally one downcomers is provided for every 1000 sq.m. of plinth area or part thereof.

However the number of down comer can be suitably increased to meet the given situation.

TABLE 2.1

VARIOUS COMPONENTS OF FIRE FIGHTING INSTALLATIONS (UNLESS OTHERWISE DIRECTED AS PER SITE CONDITIONS)

S.NO	System components	Wet Riser	Down comer	Wet Riser cum Down Comer	Automatic Sprinkler and Wet Riser cum Down Comer
(i)	Electric Motor Driven Fire pump	Y	N	Y	Y
(ii)	Diesel Engine Driven Fire Pump (as stand by)	Y	N	Y	Y
(III)	Pressurization Pump (jockey Pump)	Y	N	Y	Y
(iv)	Terrace Pump	N	Y	Y	Y
(v)	Vertical risers in the building.	Y	Y	Y	Y
(vi)	Pipe network inside the building through out the building protected with nozzles.	N	N	N	Y
(vii)	External pipe line around the building.	Y	N	Y	Y
(viii)	Internal Hydrant.	Y	Y	Y	Y
(ix)	Yard Hydrant (External Hydrants)	Y	N	Y	Y

(x)	First-aid hose reel.	Y	Y	Y	Y
(xi)	Hose Pipe and Branch Pipe.	Y	Y	Y	Y
(xii)	Air Vessels.	Y	Y	Y	Y
(xiii)	fire service Connections.	Y	N	Y	Y
(xiv)	fire service inlet.	Y	Y	Y	Y
	Controls components like pressure switches, flow switches level indicator, alarm etc.				
(xv)	Electrical Power and Control Panel with cable and earthing etc.	Y	Y	Y	Y
(xvi)	Pipe line accessories like Butterfly/Sluice Valve, Non-Return Valve etc.	Y	Y	Y	Y
(xvii)					

'Y' Stands to be provided.

'N' Stands not to be provide.

2.4.1.7 Internal Hydrant:- Every riser will be provided with the following at every floor including

Terrace and basement over and above sprinkler system.

- | | | |
|-------|--|---------|
| (i) | Single headed out let | -2 NOS. |
| (ii) | First Aid Hose reel | - 1 No. |
| | [Length of pipe shall be such that nozzle of the Hose can be taken into every room and within 6 Mts. Of any part of the room keeping in view Layout and obstruction.] | |
| (iii) | Hose pipe 63 mm.dia 15 m. long with male and female Coupling at both ends. | -2 Nos. |
| (iv) | Branch pipe 63 mm. dia with 20 mm. (nominal internal diameter) Nozzle and suitable for instantaneous | -1 No. |

2.4.1.8 Yard Hydrant (External Hydrants)

2.4.1.8.1 For fighting fire from out side the building, yard hydrants are provided around the building and Building and in the closed court yard. For connecting yard hydrants a ring of pipe shall be laid Under ground around the building at a minimum distance of 2 m. form the face of the Building. All internal hydrants risers shall be connected with this ring.

Yard hydrants shall be located at a minimum distance of 2 m. but not more than 15 m from

the building face. Yard hydrants shall be accessible and should normally be provided near boundary wall/along road. While locating yard hydrants it should be ensured that same do not become hindrance in vehicular movement or entrance to the building. Yard hydrants, should be hydrants, should be located around the building in such a way that it should be possible to fight fire on any face of the building from the nearest hydrant. A distance of 45 m. from hydrant to hydrant will be adequate.

2.4.1.8.2 Yard hydrant will include the following accessories.

- (i) Connection from ring main with 80 mm dia MS pipe.
- (ii) 63 mm dia single head landing valve - 1No.
- (iii) Butterfly/sluice valve 80 mm dia - 1 No.
- (iv) Hose pipe 63 mm dia 15 m. long
With male and female coupling at both ends -2 Nos.
- (v) Branch pipe 63 mm dia with 20 mm
(nominal internal diameter) nozzle
And suitable for instantaneous connection - 1 No.

All above components shall be housed in a suitable size MS cabinet made from 2 mm thick sheet with glass door. The cabinet shall be painted red as per para 1.13.

(**Note:-** In case hose pipes and branch pipes are likely to be stolen from yard hydrants, the same will be kept in a central places i.e. fire control room/ fire pump room.)

2.4.1.9 **Fire Service inlet :-** In order to facilitate feeding of water in the system by fire service. a 2/3 Way 63 mm dia collecting head shall be provided and connected with each riser/down comer and the ring main with non return valve and butterfly/sluice valve. This should be located at a place where fire brigade tender can reach.

2.4.1.10 **Fire Service connection:-** In case under ground storage tank is not approachable by fire Tenders, a 4 way 63 mm diameter instantaneous male inlet connection is provided at street level and connected to UG tank with 150 mm diameter under ground pipe.

2.4.1.11 **Air Vessel :-** To counteract the water hammer effect, air vessels shall be provided one at top of Each riser.

2.4.1.12 **Orifice Plate:-** To reduce pressure on individual hydrant to operating pressure of 3.5kg/cm², Orifice plate shall be provided before connection of hydrant.

2.4.1.13 **Alarm:-** To indicate the flow of water in the system, turbine type alarm shall be provided Out side the pump house in the main line before any connection is taken.

The alarm will indicate the healthiness of the systems and shall not be silenced till the main fire pump is in operation.

2.4.1.14 Control system :-

2.4.1.14.1 The system shall be designed for operation automatically so that as and when water is drawn

From the system through any hydrant, the pumps will operate automatically and feed water

into the system. However once a fire pump starts working, it will be stopped only manually

(except jockey pump) or low water level in UG/Terrace tank.

Facility shall also be provided for manual operation. A selector switch for auto/manual

selection shall be provided in each pump.

2.4.1.14.2 The control system shall be designed to provide the following sequence of operation.

- (a) The Pressurisation Pump shall maintain pressure in the system and shall operate only on account of slow pressure loss. In case of sudden pressure loss the Pressurisation Pump shall not operate. The pump shall start when the water pressure in the system falls to a pre-set value (about 0.35 kg./cm² below normal system pressure) and shut down when the system pressure reaches the set value. Both limits shall be adjustable.
- (b) Main Electric Fire Pump shall operate on account of sudden pressure loss. So long as main Electric fire pump is working, other fire pumps will not operate. The pump shall start when the water pressure falls to a pre-set value in the system (about 1 kg./cm²).
- (c) The Diesel Fire Pump will start on sudden pressure loss, only in case supply to Main Electric Fire Pump is not available or within a pre-set time the Main Electric Fire Pump fails to start fails during operation. No other pump will be working when Diesel Engine Fire pump is in operation. Audio-Visual Alarm shall be available to indicate failure of Main Electric Fire pump.
- (d) A three attempts starting facility will be provided for diesel pump.
- (e) If within a pre-set time, the standby pump also fails to start or fails to develop pressure, the standby pump shall also be shut down and locked out. An audio visual Alarm indication shall be given at the control panel.
- (f) The Terrace Pumps will start on sudden loss of pressure only when both the fire pumps

Have either failed to start or exhausted water.

- (g) Only one pump will be working at a time. In manual mode more than one pump can be Started.
- (h) Water level in UG and terrace tanks shall be monitored and in case of low water level, Pumps connected with the tank shall not operate (even on manual mode) or stop Operation as the case will be. An audio-visual alarm shall be given at the control Panel.

2.4.2 Wet Riser :- In wet riser system all components described in 2.4.1. shall be provided except terrace pump. Terrace tank shall also not be required.

2.4.3 Down Comer :- In down comer, under ground tank, fire pumps at ground level, ring main and yard hydrant will not be provided. Except these items, all other items described in 2.4.1 shall be provided. Following points are also to be taken in to consideration.

2.4.3.1 A minimum of two terrace pumps (electrical) shall provided. One pumps shall act as standby.

2.4.3.2 **Down Comer Pipes:-** Consideration of para 2.4.1.6 shall apply.

2.4.3.3 All down comer pipes shall be inter connected at the terrace level. In case terraces are not interconnected, all building will be treated as individual buildings.

2.4.3.4 Fire service inlet shall be provided with each riser for facilitating pumping of water from fire service tenders.

2.4.3.5 **Control system :-** The starting of terrace pump shall be automatic i.e. with the opening of any hydrant valve or hose reel on any floor, the pump will start automatically with fall in line pressure. In addition start / stop push buttons shall be provided at ground floor near internal hydrant for starting the pumps manually. Where fire control room has been provided, remote operation of terrace pump will be done from fire control room in place of internal hydrant. The control panel for terrace pumps shall be provided near the pumps in a suitable enclosure to avoid unauthorized operation.

2.4.4 Automatic Sprinkler :-

2.4.4.1 In addition to all provision of Wet riser and Down comer system described in para 2.4.1, in automatic sprinkler system, water lines of various size are laid through out the area to be protected and sprinkler heads are provided at regular interval so that water from sprinkler head cover the entire area under fire.

2.4.4.2 Sprinkler has two functions to perform i.e. to detect fire and then to provide adequate distribution of water to control or extinguish it. Sprinkler heads operate at pre-

determined temperature to discharge water over the affected area below. Only those sprinkler heads operate which are in the vicinity of fire i.e. those which become sufficiently heated.

2.4.4.3 Lines for sprinklers will be separate or common with wet riser system depending upon type building.

2.4.4.4 The area to be protected by sprinkler is divided in to various zones. For detecting operation of sprinkler in a zone, flow switches are provided which are wired to an annunciation panel installed in the fire Control Room. In the event of operation of sprinkler (s) in an affected zone. This arrangement will be independent of fire alarm system.

2.4.4.5 The sprinkler shall be installed only where there is no danger of freezing of water in the pipes at any time.

2.4.4.6 Details of sprinkler installations have given in separate Chapter 9.

CHAPTER-3

ARCHITECTURAL AND STRUCTURAL REQUIREMENTS

3.1 SCOPE

This chapter outlines the guidelines for planning space requirements, equipment location, floor Loading and other structural requirements for fire fighting systems.

3.2 Following provisions/spaces are required for fire fighting system.

3.2.1 Static Water Storage Tanks:- In order to ensure satisfactory supply of water for the pumps of Pumps of fire fighting, static water storage tanks exclusively for the purpose of fire fighting shall Be provided. The tanks shall be provided both under ground and/or at terrace. The capacities Shall be determined from Appendix 'A'.

While deciding the capacities of under ground and terrace tanks following points shall also be taken into consideration.

- (i) In case common pump house and under ground tank are to be provided for more than one Building in campus, the capacity of UG tank shall be increased, if required in consultation with Local fire Brigade.
- (ii) Arrangement shall be made for replenishment of water from alternative source at the rate of 1000 ltrs. Per minute for underground tank. When this is not feasible the capacities of storage Tanks (both underground and terrace tanks) shall be increased suitably in consultation with local Fire brigade.

3.2.1.2 Following factors are to be considered for deciding the location of underground water storage Tank.

- (i) The tank shall be by the side of road so that fire brigade personnel can draw water from the tank or Discharge water into the tank. Suitable manhole shall be provided for this purpose.
- (ii) When the slab of the tank forms a part of pathway/drive way, it shall be designed to withstand the vehicular load of 40 tonnes.
- (iii) Arrangement shall be made to replenish water by mains or alternative source.
- (iv) Suitable arrangement shall be made to prevent stagnation of water in the tank. For this purpose, The tank of domestic or other water supply will be fed from the over flow of static water storage Tank to ensure desired water level.

(v) The static water storage is meant for fire fighting only and is not to be used for any other purpose Except when the tank is to be cleaned.

(vi) There shall be no leakage in the tank.

3.2.1.3 Following factors are to be considered for deciding the location of terrace tank.

(i) The terrace tank should be easily accessible.

(ii) Connection to terrace pump shall be conveniently made.

(iii) Factors at 3.2.1.2 (iii) to (vi) shall be conveniently made.

(iv) The terrace tank will be of masonry, cement concrete, M.S. or plastic depending upon Considerations.

3.2.2 Pump House :- For installation of fire fighting pumps (Main Electrical Pump, Diesel Electrical Pump, Diesel Engine Driven and Pressurisation Pump along with Electrical Control panel) pump House is required. Following factors are to be considered.

(i) In order to provide positive (flooded) suction to fire pumps, the pumps house shall be at a level Below or equal to that of static water storage tank.

(ii) The pump house shall be easily accessible for fire fighting operations and at least 6 meters away From the building.

(iii) The pump house shall not be located in the building to be protected.

(iv) Water supply pump can be installed in the same pump house.

(v) The size of the pump house shall be not less than 6.0 m.(w) x 8 m.(L) x 3.5 m.(H). If two electrical Pumps are to be provided, the length of the pump house shall be not less than 12 m. if the water Supply pumps are to be installed in the same pump house, then either the width of pump house Be increased by 1m. or length be increased by 2 m. or suitably as is necessary.

(vi) Suitable ramp shall be provided for lowering the equipment in to the pump house. Stair case with Entry door at ground level and locking arrangement shall be provided.

(vii) Ventilators at least 500 mm. high shall be provided on three sides for natural light. Adequate Ventilation for dissipation of heat due to operation of motors/engine shall be provided.

(viii) Proper water proofing shall be provided. A sump of size 0.6 m x 0.6 m x 0.3 m shall be provided In the pump house in one corner adjacent with the tank wall. The floor slope will lead towards The sump so that water leakage can be pumped out.

(ix) In order to ensure that there is no leakage of water in the pump house, no pipe/cable shall Cross the pump house below ground level. Suitable opening in wall above ground level shall be Provided for crossing of pipe/cables.

(x) Where it is not possible to construct pump house under ground, the same will be constructed Over ground. However automatic priming arrangement shall be made to ensure operation of Pumps without priming. (As per para 4.5.6). Typical arrangement of pumps with priming.

(xi) There shall be no beam under the floor of pump house.

(xii) The floor of the pump house shall be designed for loading of 1500 kg./sq.m. foundation of Pumps shall be raised over finished floor and in no case flooring or RCC walls shall be damaged While installing equipment in the pump house.

(xiii) The pump house shall be clearly Marked by luminous sign.

3.2.3 Terrace Pump – Terrace pump is to be installed near terrace tank. The tank shall be at higher Level to provide positive suction to the pump. No separate pump house is required for terrace Pump. However suitable enclosure for protection of pump is to be provided. The pump will be Located near beam so that its load is not transferred to slab.

3.2.4 Internal Hydrant – Internal Hydrants are provided to fight fire from within the building. Following factors are considered for deciding location of internal hydrant.

(i) Internal hydrants are provided at every floor at the same location and connected with risers.

(ii) Numbers and location of risers shall be decided as per para 2.4.1.6. Every wing of the building Shall preferably be provided with independent hydrants. Hydrant shall be located in the center of The building so that one hydrant can cover area on both sides.

(iii) A masonry enclosure on three sides of size minimum 1200 mm wide and 800 mm. deep and 2100 mm. height shall be provided. Cut of size 200 mm. x 200 mm be provided in one corner in The slab for down comer/wet riser pipe. If sprinkler installations are to be provided additional cut Out of similar size for sprinkler pipe and drain pipe as the case will be, shall be provided. Steel Shutter with 1250 mm. glazing on top with locking arrangement shall be provided in front of the Hydrant. The shutter shall be painted red as per para 1.13.

- (iv) Internal hydrant shall be easily accessible and provided near stair case. A clear space of at least 1.5 m. should be available in front of the internal hydrant for operation. Internal hydrant shall not be provided in a lockable room.
- (v) Internal hydrant shall be clearly marked with the inscription of "FIRE HYDRANT" by luminous sign. Suitable lighting arrangement shall be provided in front of the internal hydrant.

3.3 BUILDING TO BE SPRINKLER PROTECTED

The sprinkler pipes are installed through out the area to be protected. The structure shall be designed to support sprinkler pipes and the contained water. Inbuilt drainage with slope shall be provided through out the area so that event of operation of sprinkler, water is drained out without spreading to other parts of the building. Storage racks/platforms shall be sufficiently raised above floor.

3.4 FIRE CONTROL ROOM

For all buildings 15 m. in height or above, and apartment buildings with height 30 m. and above, a fire control room (size 4 m x 4 m approximately) shall be provided on the entrance floor of the building. Once store for keeping spares for fire fighting system shall also be provided adjacent with the fire control room.

CHAPTER-4

PLANNING, DESIGNING AND COORDINATION

4.1 INTRODUCTION

Planning of fire fighting system is to be done right at the stage when the building plans are Prepared by the Architect. Subsequently during preparation of working drawings, all architectural And structural provisions described in Chapter 3 are also to be kept in the building plans.

Careful planning from the initial stage itself will avoid changes and problems at a later stage. This Chapter covers aspects of planning, designing and coordination of fire fighting system. **This being existing building with already existing fire fighting system the modifications along with repairs etc shall be done to all possible extent in order to achieve the optimum fire safety.**

4.2 SCHEME

The provision of fire fighting installation depends upon building use, height, floor area etc. Considering these factors, the system or a combination of systems which will be required to be Adopted should be finally selected in accordance with National Building Code and regulations of Local fire authorities, if applicable.

4.3 APPROVAL OF LOCAL BODIES

If the building plans which are submitted to local bodies for approval, details of fire fighting System in the building are indicated.

4.4 ARCHITECTURAL PROVISION

4.4.1 For any fire fighting system, Water tank Dedicated to Fire Fighting Requirement and Fire pumps are required. These will be Located any where in the campus subject to proper approach.

4.4.2 The shafts for vertical Down comers are to be provided in the building. Their number and location be

Decided as per guidelines given in Chapter 2 and 3.

4.4.3 Location of yard hydrant shall be selected in accordance with provision of para 2.4.1.8

4.4.4 Details of internal hydrants MS door with glass is provided to concerned architect/ division in advance. This will be modified for architectural considerations provided the glass height is not changed.

4.4.5 Sprinkler pipes are laid through out the area to be protected. The route of pipes is to be pre- Decided in consultation with the Architect. For vertical pipes, shafts for risers are to be used. Layout of horizontal pipe and location of sprinkler head are to be decided keeping in view of Location of and fitting. In case false ceiling is being provided in the area, horizontal pipes will be Laid above false ceiling and only sprinkler head is provided below false ceiling. If centrally air-

Conditioned, location of duct and air termination will be taken into account. Reflected ceiling Plan shall be prepared indicating all services above false ceiling.

4.5 DESIGNING

4.5.2 The pipe sizes shall be selected as under:-

(i) Suction and delivery pipes of pumps shall be not less than following.

	Pump Discharge	Suction dia (mm)	Delivery dia (mm)
(a)	450 lpm	50	50
(b)	900 lpm	75	50

(ii) Pipe from pump outlet to terrace ring main connection shall be not less than 150 mm dia.

(iii) Down comer pipe size shall be of 100 mm dia.

(iv) Down Comer pipe size shall be 100 mm dia except business buildings more than 30 mtr in height where the same shall be 150 mm dia.

(v) Where wet riser/down comers are not to be provided but hose reel and terrace tanks are to be provided. Pipe of size 65 mm diameter shall be provided in between the pump and hose reel.

(vi) Fire service in let and fire service connection shall be with pipe size not less than 150 mm dia.

(vii) All tee off connection for landing valve from vertical risers or from ring main for external hydrants shall be with pipe size not less than 80 mm. dia.

4.5.3 **Selection of Material** :- Components like landing valve, hose coupling branch pipes etc are Available in three material i.e. Aluminum Alloy, Gun metal and Stainless steel, Aluminum Alloy is prone to wear and tear and weather conditions faster than other two materials. However being Cheaper, Aluminum Alloy will be used in location where chances of pilferage are more. Stainless steel will be considered at location not very safe from theft. Gun metal will be used in installations which are well protected.

4.5.4 **Hose Pipes/ Branch pipes** :- A minimum of two number of 63 mm dia 15 m long hose pipe with Instantaneous coupling at both ends and one number branch pipe with nozzle shall be kept with Every internal and external hydrant.

4.5.5 **Orifice Plate** :- The pressure in a fire fighting system varies from point to point. The pressure will maximum at the farthest hydrant at terrace level. To reduce pressure to operating pressure at every internal/external hydrant, orifice plates are provided before connection of landing valve

between the flanges of landing valve and pipe flange. The size of orifice shall be calculated as per details given in Table 4.1

**TABLE 4.1
SELECTION OF ORIFICE PLATE**

Pressure Loss Kg/cm ²	Diameter of Orifice	
	Pipe Size	
	80 mm	100 mm
3.5	41.9	
3.0	43.0	
2.5	44.80	
2.0	46.40	
1.5	48.90	56.20
1.0	52.30	57.60
0.9	53.20	59.00
0.8	54.10	60.40
0.7	55.30	62.00
0.6	56.60	63.90
0.5	58.20	66.50
0.4	59.80	69.70
0.3	62.00	74.20
0.2	65.00	81.10
0.1	-	82.20

4.5.6 Automatic Priming Arrangement :- Where it is not possible to provide positive suction for fire Pumps and pressurization pump, automatic priming arrangement shall be provided. All pumps will Independent suction without stop valve. Foot valve shall be provided at the end of suction pipe in The tank.

A tank of capacity not less than 2500 ltrs. shall be installed at least 2-3 m. above the highest level Of the pumps. The tank shall be connected by 50 mm.dia pipe with delivery side of each pump (before non-return valve). A stop valve and non return valve shall be provided in each connecting Pipe.

For filling the priming tank, one horizontal monoblock submersible pump shall be installed in the Water storage tank which shall operate automatically with low and high level switches provided in The priming tank. The pump motor shall be connected with the electrical panel of pressurization

Pump.

The priming tank shall be made of M.S., 3 mm. thick sheet and welded construction. The tank shall be installed either on the terrace of pump room or inside the pump room on suitable Pedestal. Over flow and drain connections shall be provided and water returned to the water Storage tank.

Level indicator shall be provided for indicating water level in the priming tank.

Typical arrangement of automatic priming has been shown in Fig.6.

4.6 COORDINATION

4.6.1 Award of Work :- Depending upon progress of building work, the work of fire fighting should be Should be awarded well in time.

4.6.2 Power and Water supply for Erection :- If the department is to provide power and water for Erection, the same should be made available before start of the work since without these Facilities, fire fighting work can not be started.

4.6.3 The Pump house and underground tank where main equipments are to be installed should be Available immediately after the work has been awarded. During Construction of under ground Tank, 2 Nos. 200 mm dia MS – C Class pipe with flanges on both sides shall be embedded for Connection with suction header of the fire pumps. In case separate sprinkler pumps are to be Provided, additional pipes shall be embedded as per actual requirement. The pipe shall be Extended at least 100 mm. on both sides of the finished wall.

4.6.4 The underground tank and pump house shall be tested for any leakage / seepage before start of The work. This shall be ensured that both tank and pump house are free from leakage/seepage.

4.6.5 The work of laying of pipe for sprinkler should be taken up in coordination with the ducts Installation in case of building

4.6.6 The sprinkler pipes should be tested area wise and capped for connection to pipes of adjoining Area.

4.6.7 The route of external pipe i.e. pipe from pump house and ring should be decided in coordinat- on with other building services. Guide lines of Chapter 2 and 4 are to be followed. It will be desirable to prepare a services drawing where all service i.e. sewage, drainage, water supply lines, UG cable, pipes for air-conditioning and fire fighting are reflected.

4.6.8 Riser pipes shall be installation after the riser shafts are available duly plastered.

4.6.9 For laying of external pipes, excavation up to a depth of 1.25 m or more is to be carried out. This will cause hindrance in execution of other building works. External pipes shall therefore

Be laid in a phased manner in coordination with other agencies. The pipes shall be tested and Earth filled back before excavation for next phase is taken up. Equipment for testing etc should Be available in advance before start of underground pipe laying work.

- 4.6.10** All underground pipes are to be laid much before starting of finishing work i.e. pavement, Road/ horticulture work etc around the building.

CHAPTER-5

FIRE PUMPS

5.1 SCOPE

This chapter covers the general requirements of water pumps for main fire pump, jockey pump And terrace pump.

5.2 TYPE

The pumps shall be centrifugal type direct driven with a 3 phase, 415 V \pm 10%, 50 Hz., A.C. motor. The standby fire pump shall be driven by diesel engine. The pumps will be either of horizontal split Casing (with operating speed not exceeding 3000 rpm. As specified in the tender documents.

5.3 RATING

The main fire pumps and terrace pump shall be suitable for continuous operation in the system. The jockey pump shall be suitable for intermittent operation to built up pressure in the system on account of leakage. The head and discharge requirements shall be as specified in the tender documents. The head shall be suitable for the system and shall take into consideration the pressure drops across the various components in the water circuit as well as the frictional losses.

Pump shall be capable of discharging not less than 150 percent of the rated discharge at a head of not less than 65 percent with the rated head. The shut off head shall not exceed 120 percent of the rated head.

5.4 MATERIAL AND CONSTRUCTION

- (i) The centrifugal pumps shall conform to IS 1520.
- (ii) The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the working pressure. The casing shall be provided with shaft seal arrangement as Flanges for suction and delivery pipe connections as required.
- (iii) The impeller shall be of bronze or gunmetal. This shall be shrouded type with machined collars Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The Impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be Secured to the shaft by a key.
- (iv) The shaft shall be of stainless steel and shall be accurately machined. The shaft shall be Balanced to avoid vibrations at any speed within the operating range of the pump.
- (v) The shaft sleeve shall be of bronze or gunmetal.
- (vi) The bearings shall be ball or roller type suitable for duty involved. These shall be grease Lubricated and shall be provided with grease nipple/cups. The bearings shall be effectively Sealed against leakage of lubricant or entry of dust or water.

- (vii) The shaft seal shall be mechanical type, so as to allow minimum leakage. A drip well shall be Provided beneath the seal.
- (viii) The pumps shall be directly coupled to the motor/diesel engine shaft through a flexible Coupling protected by a coupling guard.
- (ix) The pump and motor/diesel engine shall be mounted on a common base plate fabricated From mild steel section. The base plate shall have rigid, flat and true surfaces to receive the Pump and motor/diesel engine mounting feet. The pump will be perfectly aligned with the Motor/engine so as to avoid any vibration during.

5.5 ACCESSORIES

Each pump shall be provided with the following accessories:-

- (a) Butterfly/sluice valves on suction and discharge (If positive suction is not provided butterfly Valve at suction is not to be provided).
- (b) Reducers, as will be required to match the sizes of the connected pipe work.
- (c) Non-return valve at the discharge.
- (d) Pressure gauge at discharge side between pump and the non-return valve.

5.6 INSTALLATION

- (i) The pump and motor/engine assembly shall be mounted and arranged for ease of Maintenance and to prevent transmission of vibration and noise to the building structure or to
- (ii) The pump and motor/engine assembly shall be installed on suitable RCC foundation. The Length and width of the foundation shall be such that 100 mm. space is left all around the Base frame. The height of foundation shall be so decided that total weight of foundation block is 1.5 times the operating weight of the assembly. The foundation shall be isolated from the floor the by vibration isolating pads. Angle iron frame of size 35 mm x 35 mm x 3 mm shall be provided on the top edges of the foundation.
- (iii) More than one pump and motor assembly shall not be installed on a single base or cement Concrete block.
- (iv) The suction/discharge pipe shall be independently supported and their weight shall not Be transferred to the pump. It should be possible to disconnect any pump for repairs without Disturbing the connecting pipe line.
- (v) A minimum clearance of 1 m. around the main pumps shall be provided. For jocky pump- Clearance of 75 cm. shall be adequate.

- (vi) Sufficient space is to be left in front for the radiator of diesel engine for free discharge of hot air. Arrangement for discharging hot air to out side the pump house shall be provided so that hot air to does not stagnate in the pump house.

CHAPTER-6
DIESEL ENGINE FOR FIRE PUMP (NOT APPLICABLE)

CHAPTER-7

PIPE WORK

7.1 SCOPE

The chapter covers the requirements of pipe work in fire fighting installations.

7.2 PLUMBING DESIGN

Pipe sizes shown in tender documents are purely for contractor's guidance. The contractor shall be responsible for selection of sizes as per detailed engineering to be done by him. Plumbing design to be done by the contractor shall incorporate the following:-

- (i) (a) Butterfly/slucie valves shall be provided at suction and delivery sides of pumps.
(If positive suction is not provided valve at suction is not to be provided).
- (b) External hydrant
- (c) Fire service connection/inlet.
- (d) Test valve.
- (e) Drain connections.
- (ii) For testing the system healthiness and automatic operation on daily basis, one test pipe with Butterfly/slucie valve shall be provided in common discharge header. For avoiding wastage of Of water, this pipe shall discharge water in the tank.
- (iii) Non return valve shall be provided at the delivery of each pump and fire service inlet. This be of Swing type.
- (iv) Air release valve with ball valve shall be provided in the piping system for venting trapped air with With a size of 25 mm for pipes upto 100 mm and 40 mm for larger pipes.
- (v) Plumbing drawings showing the sizes of pipe, valves, layout and other details shall be prepared and

Shall be got approved from the Engineer-in-Charge before the execution of plumbing work.

7.3 PIPE MATERIALS

(i) Pipes shall be of the following materials.

- (a) Mild steel heavy class (C-class) conforming to IS: 1239 for sizes upto 150 mm.
- (b) Welded black steel pipe, class 2, conforming to IS: 3589, for sizes greater than 150 mm.

These pipe, shall be factory rolled and fabricated from minimum 6mm thick M.S. sheet for pipes upto 350 mm dia and from minimum 7 mm thick M.S. sheet for pipes of 400 mm dia and above.

- (c) Cast iron double flanged class-‘A’ conforming to IS:1536 or IS : 1536(to be provided only in under ground application).
 - (d) GI pipe medium class (B-class) conforming to IS:1239 (for Drain).
- (ii) Cadmium plated steel nuts/bolts/washers shall be used.

7.4 PIPE JOINTS

- (i) Electric welding joints shall be provided in the M.S. pipe work. Flanged joints shall be provided for Connections to valves, pumps, air vessels etc. and also on straight length at suitable points to Facilitate erection and subsequent maintenance.
- (ii) For connection of C.I. pipe, fittings shall also be of C.I. heavy grade conforming to IS:1538. The Flanges shall be smooth faced and neoprene gasket shall be provided. Where un-avoidable and to Connect under ground pipe with risers, M.S. pipe will be used in the form of distant pieces. The Between C.I.and M.S. pipe shall be flanged type. M.S. pipe laid at such locations shall be provided Anti-corrosive treatment as per para 7.12.
- (iii) Mild steel flanges shall be in accordance with table- 17 of IS :6392 i.e. “Plate Flanges for Welding” and flanges thickness shall be as under. Gasket thickness shall not be less than 3 mm.

Pipe dia	Flange Thickness
200 mm.	24 mm.
150 mm and 125 mm.	22 mm.
100 mm and 80 mm.	20 mm.
65 mm.	18 mm.
40 mm and below.	16 mm.

All hardware items such as Nuts, Bolts, washers shall be of appropriate size. Washers shall be

Used on both sides of the bolt.

7.5 VALVES

Sluice valve conforming to IS: 780 or butterfly valve conforming to IS:13095 shall be provided. All Valves shall be suitable to with-stand the pressure in the system and rating shall be PN. 1.6. all Valves shall be right handed (i.e. handle or key shall be rotated clock wise to close the valve), the Direction of opening and closing shall be Marked and an open/shunt indicator fitted.

(i) The material of valves shall be as under:

Body – Cast iron

Disc- Cast Bronze or Stainless Steel

Seat- Either integral or Nitrile rubber

O-ring- Nitrile/ Silicon

(ii) Non return valves shall be swing check type in horizontal run and lift check type in vertical run of Pipes.

(iii) Air release valves shall be of gunmetal body.

7.6 STRAINERS

Stainless steel strainers shall have minimum 1 mm thick screen with 3 mm perforations. Strainers Strainers shall be provided with flanges.

7.7 ORIFICE PLATE

Orifice plate shall be made of 6 mm. thick stainless steel and shall have an identification tag Projecting beyond any flange between which it is clamped. The orifice shall be plain central hole Without burrs and diameter not less than one-half of the internal diameter of the pipe to which it is Fitted.

7.8 INSTRUMENTS

(i) Pressure gauge of appropriate range and 150 mm. dia size shall be provided.

(ii) The pressure gauge shall be duly calibrated before installation and shall be complete with shut Off valve.

7.9 AIR VESSEL

Air vessel shall be provided on top of each riser and shall be fabricated out of 8 mm. thick M.S.sheet .the ends shall be dished. This shall be of 250 mm.dia, 1.2 m. high and installed vertically on Suitable legs. The legs shall be provided with M.S. plate of size 75 mm x 75 mm x 5 mm at the Bottom so that the legs do not puncture the roof. The legs shall be grouted in CC foundation. Flange connection shall be provided for connection with down comer pipe. Air release valve and

Pressure gauge with shut off valve shall be provided. The air vessel shall be tested at 25 kg/cm² Pressure before installation.

7.10 INSTALLATION

- (i) The installation work shall be carried out in accordance with the detailed drawings prepared by the contractor and approved by the Engineer-in-charge.
- (ii) In pipe above ground level, expansion loops or joints shall be provided to take care of expansion Or contraction of pipes due to temperature change.
- (iii) Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the Main pipe shall be used. Darling and tapping of the walls of the main pipe shall not be resorted to.
- (iv) Open ends of piping shall be blocked as soon as the pipe is installed to avoid entrance of foreign Matter.
- (v) Piping installation shall be supported on or suspended from structure adequately. The contractor Shall provide, clamps, hangers etc. in accordance with para 7.13.

Proper lines and levels shall be maintained while installing exposed pipe.

Spacing of pipe supports shall not be more than that specified below:-

Nominal Pipe Size (mm)	Spacing (m.)
20 and 25	2.00
32 to 125	2.50
150 and above	3.00

Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stress on the pipes.

- (vii) Anti vibration pads, springs or liners of resilient and non-deteriorating material shall be provided at Each supports, so as to prevent transmission of vibration through the supports.
- (viii) Pipe sleeves of diameter larger than the pipe by least 50 mm shall be provided wherever pipes Pass through walls and the annular spaces shall be filled with felt and finished with retaining rings.
- (ix) (a) Vertical risers shall be parallel to walls and column lines and shall be straight and in plumb.

Risers passing from floor to floor shall be supported at each floor by clamps as per para 7.13.

- (b) The space in the floor cut outs around the pipe work shall be closed using cement concrete (1:2:4 mix) or steel sheet, from the fire safety considerations, taking care to see that a small Annular space is left around the pipes to prevent transmission of vibration to the structure.
- (c) Riser shall have suitable supports at the lowest point.
- (x) Where mild steel pipes are to be buried under ground the same shall be treated in accordance with Para 7.12 before laying. The top of pipes shall be not less than 100 cms. Below the ground level. Where this is not practicable, permission of the Engineer-in-charge shall be obtained for burying the pipes at lesser depth. Masonary or C.C. blocks shall be provided for supporting the pipes at interval in accordance with para 7.10(vi). After the pipes have been laid, after the pipes have been laid, the trench shall be refilled with the excavated soil in layers of 20 cm. and rammed and any extra soil shall be removed from the site of work by the contractor.
- (xi) Underground pipe shall be laid at least 2 m. away from the face of the building preferably along the roads and foot paths. As far as possible laying of pipes under road, pavement and large open spaces shall be avoided. Pipes shall not be laid under building and where unavoidable, these shall be laid in masonry trenches with removable covers.
- (xii) To facilitate detection of leak and isolation of defective portion of ,valves shall be provided in Under ground pipe at suitable locations. As far possible such valves shall be provided over ground. If the valves are to be provided below ground, suitable masonry chamber with cover plate shall be provided. Locations where vehicles can pass shall be avoided for provision of valve below ground.
- (xiii) Pipe over ground shall be painted in red colour as per para 1.13. Suitable identification shall be Provided to indicate the run of under ground pipe wherever the route of underground pipe can not be ascertained from the location of yard hydrant/isolating valves.
- (xiv) It shall be made sure that proper noiseless circulation is achieved in the system. If proper circulation is not achieved due to air-bound connection, the contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification, including the tearing up and refinishing of floors, walls, etc. as required.

7.11 PRESSURE TESTING

- (a) All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg/sq. cm. for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of Engineer-in-Charge.
- (b) Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

- (c) System will be tested in sections and such sections shall be securely capped.
- (d) Pressure gauges will be capped off during pressure testing of the installation.

7.12 ANTI-CORROSIVE PROTECTION ON UNDER GROUND PIPE

Corrosion protection tape shall be wrapped on M.S. pipes to be buried in ground. This corrosion Protection tape shall comprise of coal tar/asphalt component supported on fabric of organic or Inorganic fibre and minimum 4 mm. thick and conform to requirement of IS: 10221-code of Practice for coating and wrapping of under ground mild steel pipe line. Before application of Corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be would around the pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15 mm. and 250 mm. shall be left uncoated on either end of pipe to permit installed and welding. This area shall be coated institution after the pipe line is installed. The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre- heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

7.13 PIPE SUPPORTS

For installing pipes vertically or horizontally inside the building standard pipe supports of reputed make shall be used. Following supports shall be used.

- (i) Split pipe support clamps with rubber lining for vertical, horizontal and roof hanging.
- (ii) Clevis Hangers for horizontal supports to adjust varying heights.
- (iii) Sprinkler Hangers for horizontal supports for pipe from 15 mm dia to 150 mm dia.

Fastners and fully threaded rods shall be used for installing the pipe supports. The sizes of pipe Supports and installation shall be in accordance with manufacturers recommendations.

For pipes of sizes 100 mm and above, with the approval of Engineer-in-Charge, 'U' clamp with dash Fastner will be used for supporting horizontal pipe from ceiling.

7.14 MEASUREMENT

Measurements of plumbing work shall be on following basis:-

- (a) Piping shall be measured along the centre line of installed pipes including all pipe fittings and accessories but excluding valves and other items for which quantities are specifically indicated in

the schedule of work. No separate payment shall be made for fittings and accessories.

- (b) The rates for piping work shall include all wastage allowances, flanges pipe supports, hangers, excavation, refilling, testing, nuts and check nuts, vibration isolators, suspension where specified or required, and any other any other item required to complete the piping installation. None of these items will be separately measured and paid.

CHAPTER-8

FIRE FIGHTING ACCESSORIES

8.1 SCOPE

This chapter covers landing valves, first aid hose reels, hose pipes, branch pipes etc, which are Vital tools for fire fighting.

8.2 LANDING VALVE

Landing valve are provided in the system for connection of hose pipes discharging water for Fighting fire by fire brigade or trained personnel.

8.2.1 The landing valves shall be as per I.S.: 5290

8.2.2 The landing valves are of single and double head outlet types.

8.2.3 Material of construction.

- (i) Body, outlet and cap etc : Bronze or Aluminium alloy or stainless steel
- (ii) Spindle : Brass for Bronze body, stainless steel for aluminium alloy and stainless steel body.
- (iii) Hand wheel : Mild steel or cast iron.

8.2.4 The water discharge shall be not less than 900 lpm for single head and 1800 lpm for double head valves at 7 kg/cm² pressure.

8.2.5 Installation

8.2.5.1 The landing valve shall be fitted to a T connection of the riser at the landing in such a way that the valve is in the centre of the internal hydrant opening and at a height of 1m. from floor level.

8.2.5.2 The valve base shall be vertical and the valve facing out side. There should be no hindrance in operation of the handle.

8.3 FIRST AID HOSE REEL

First Aid Hose reel is meant for delivering small quantity of water in early stage of fire and can be operated even by untrained personnel. And thus provides a most effective fire fighting facility. It consists of a length of 20 mm (nominal internal) diameter hose tubing warped around a reel with water inlet pipe, stop valve and shut off nozzle. The entire assembly is mounted on a wall bracket and can swing 180 degree. The water inlet is connected to the pipe by means of 37 mm

socket and valve. The hose tube can be pulled out easily for the purpose of discharge of water on fire.

8.3.1 First aid hose reel shall be as per IS-884. The coupling, branch pipe and nozzle shall be as per IS: 884. The coupling, branch pipe and nozzle shall be as per IS:8090

8.3.2 Material of Construction:-

- (i) Hub and sides : Aluminium Alloy / Mild steel / Aluminium sheets.
- (ii) Wall Bracket : Cast iron / Mild steel.
- (iii) Hose tube (20) : Thermoplastic (Textile Reinforced) Type-2
(nominal internal dia) as per IS-12585
- (iv) Nozzle with branch Pipe : Brass.
- (v) Stop valve (Ball valve) : Gun metal.

Normally M S Construction is used. Other material will be used in areas having corrosive Atmosphere.

8.3.3 The water flow rate shall be not less than 24 lpm and the range of jet shall be not less than 6 m.

8.3.3 Installation

8.3.4.1 First aid hose reels are installed with internal hydrant (para 2.4.1.7.) space for which is provided as per para 3.2.4. where space is not provided, first aid hose reel shall be installed in suitable size MS cabinet made from 2 mm thick sheet with glass door. The cabinet shall be painted red as per para 1.13. the size of the cabinet shall be such that there is no obstruction in swinging the hose reel. The location of cabinet shall be such that it does not from an obstruction in passage / escape route.

8.3.4.2 The length of hose tube shall be such that the nozzle of the hose can be taken into every room and within arrange of 6 M from any part of the room.

8.3.4.3 There shall be no obstruction in swinging the hose reel and should be installed above landing Valve where provided.

8.3.4.4 The inlet valve shall be at 900 mm above floor level.

8.3.4.5 Hose reel bracket should be firmly grouted on the with the help of rawl bolts.

8.4 FIRE HOSE DELIVERY COUPLING, BRANCH PIPE AND NOZZLES:-

8.4.1 These are important accessories used for fire fighting operations.

8.4.2 Material of Construction

8.4.2.1 Copper Alloy.

8.4.2.2 Aluminium Alloy.

8.4.2.3 Stainless steel.

8.4.3 Delivery Hose Coupling's

8.4.3.1 The delivery hose coupling consist of male half coupling and female half coupling groves are provided on outer side on both coupling for binding hose pipes with wires. In female coupling spring loaded cam tooth is provided for holding male half coupling in position. Male half coupling and female half coupling are provided. On both sides (i.e. on one side male and on other side female) of hose pipes. Two or more pipe can be joined together with the help of these coupling instantaneously.

8.4.3.2 Sizes:- These are available in two sizes i.e. 63 mm and 70 mm. Normally sizes 63 mm is used.

8.4.4 Branch pipe and Nozzle:- Branch pipes with nozzle are mounted at the end of hose pipe. branch pipe is properly finished and free from sharp edges. During operation, a fireman has to hold the branch pipe. One end of branch pipe is fixed with hose coupling and the other end is threaded to fit nozzle.

Nozzle is tapered pipe with one end threaded internally which is fixed on branch pipe. The size of other end i.e. nozzle shall be 20 mm. (nominal internal diameter)

8.5 FIRE SERVICE INLET AND FIRE SERVICE CONNECTION

8.5.1 These are provided for connection of fire service hose pipes for either directly pressurizing the system with their pumps or filling water in the tank from a distance. In the first case non return valve with butterfly valve shall be provided for holding water pressure. Fire service inlet shall be provided with each wet riser/down comer and the ring main. The arrangement has been shown in fig. 5. These are fixed to 150 mm dia pipe and located in MS Box made of 2 mm thick mild steel sheet with openable glass cover.

8.5.2 These shall be per IS: 904.

8.5.3 Material of Construction

8.5.3.1 Copper alloy.

8.5.3.2 Aluminium alloy.

8.6 HOSE PIPES

- 8.6** Hose pipes shall be rubber lined woven jacketed and 63 mm in diameter. They shall conform to Type A (Re- inforced rubber lined) of IS: 636. They shall be flexible and capable of being rolled. Length of hose pie will be 15 m.
- 8.6.2** The hose pipe shall be complete with male and female coupling at the ends as per para 8.4.3.
- 8.6.3** Besides keeping hose pipe with internal hydrant and yard hydrant, spare hose pipes along with Branch pipes shall be kept in fire control room/pump room.

CHAPTER-9

AUTOMATIC SPRINKLER SYSTEM

9.1 SCOPE

This chapter covers the general requirement of selection, design, installation, testing, commissioning and maintenance of automatic sprinkler system for fire fighting in buildings used for other than industrial and storage purpose.

9.1.1 References:- For additional information regarding definitions, planning, design, hydraulic Calculations, table etc. following documents are to be referred to.

- (i) IS:15105:- Design and installation of fixed Automatic sprinkler, Fire Extinguisher Systems- Code Of practice.
- (ii) IS:9972:- Specification for Automatic sprinkler Heads for fire protection Service.

9.2 INTRODUCTION

Fire Fighting installations described in para 2.2.1 (i) to (iii) are to be operated manually. Delay in undertaking manual operation due to late detection and or response, will result in spread of fire. In automatic sprinkler system, sprinkler heads are provided through out the areas to be protected at specified locations such as roof a ceiling, walls, between racks, below obstructions and fitted with water supply lines permanently charged with water under specified pressure. The sprinkler operate at pre-determined temperature to discharge water over the affected area below and provide an adequate distribution of water to control or extinguish fire. Only those sprinklers which are in the vicinity of fire that is those become sufficiently heated operate. Operation of sprinkler results in flow of water which initiates fire alarm. Thus sprinklers perform two functions i.e. first to detect fire and then to provide an adequate distribution of water to control or extinguish it. Water distribution from ceiling level. Cools down the hot gas which forms beneath the ceiling of enclosure in which fire is developing. This will prevent spread of fire to adjoining areas and contain damage to limited area.

It should not be assumed that the provision of sprinkler system entirely obviates the need for Other means of fighting fire and it is important to consider the fire precaution in the premises as a whole.

The system shall be installed only where there is no danger of freezing of water in the pipes at time.

9.3 CLASSIFICATION OF OCCUPANCIES

Sprinkler are provided in industrial and non industrial building. The design of sprinkler Installation depends upon type of occupancy. Buildings are categorized under the following Classes for the purpose of designing the installations in IS 15105.

- (a) Light hazard class.
- (b) Moderate hazard class.
- (c) High hazard class.
- (d) Storage hazards.

For details of classifications, IS15105 is to be referred. All non-industrial building are classified under light hazard class with the condition "If any occupancy or block within light hazard risk is larger than 125 sq. m. in area or having a area less than 125 sq.m. but not bound on all sides by masonry or RCC walls raised up to roof, the building should be classified as moderate hazard.

Air port terminal building buildings, car parking areas within building or basement, department Stores/retail shops are also classified under moderate hazard class.

In order to satisfy above conditions, all non-industrial buildings shall be designed under moderate hazard class. Accordingly these specifications cover moderate hazard class only.

9.4 PLANNING

9.4.1 Extent of Sprinkler Protection:- But for following exceptions, sprinklers, shall be provided in the entire building.

- (a) Areas, rooms or places where the water discharged from a sprinkler will pose a hazard.
- (b) Stair case and lift well.
- (c) wash room, toilets, W.C.
- (d) Rooms or compartments where electric switch gear, transformer, DG sets and A.C. plants have been installed.

In areas under (a) alternative arrangement shall be made. Any part of the building not provided With sprinkler protection shall be separated by walls (225 mm brick or 100 mm RCC). Fire doors Not less tan 1 h in fire resistance shall be provided in the opening of such walls.

9.4.2 Design, Density and Assumed Maximum Area of operation (AMAO):- this is different for different hazards classified in para 9.3 for moderate hazard, water discharge shall be at least 5 ltrs./Min/ m² over an assumed area of operation covering 360 m².

9.4.3 Sprinkler Spacing, Arrangement and location :- Sprinkler heads will be installed on ceiling and or side walls. For selection of number of sprinkler and their location in a given area, following factors shall be considered.

- (i) Maximum Area Coverage per Sprinkler
 - (a) Side wall sprinkler -9 m²
 - (b) Ceiling sprinkler -12 m²

- | | |
|--|---------|
| (ii) Maximum Distance between sprinklers. | |
| (a) Side wall sprinkler | - 3.4 m |
| (b) Ceiling sprinkler | - 4 m. |
| (iii) Minimum Distance between sprinklers | - 2 m. |
| (iv) Maximum distance between sprinklers and Boundary. | -2 m. |

While designing sprinklers installation, the recommendation of sprinkler manufacturer shall be considered.

9.4.4 Sprinkler Heads :- Clear minimum space of 0.5 m shall be maintained below the deflector of Sprinkler head.

9.4.5 Location of Sprinkler in relation to Building Structure:-

- (i) Ceiling Sprinkler Deflector shall not be less than 150 mm and more than 300 mm below the Ceiling.
- (ii) Side wall sprinkler defector shall not be less than 100 mm. and not more than 150 mm. below the ceiling.
- (iii) If depth of a beam in an area is less than 450 mm. distance at (i) and (ii) shall be maintained and provision of beam shall not be considered. If the depth of a beam in an area is more than 450 mm, then the beam shall be regarded as a boundary.

9.4.6 Concealed Spaces:- Spaces between roofs and ceiling more than 0.8 m deep shall be sprinkler Protected as follows:-

- (a) Sprinkler heads shall be provided considering the space as any other area in the building.
- (b) Sprinkler heads will be connected individually with the range/distribution pipes below, which shall be sized by taking the room and concealed space sprinklers cumulatively.
- (c) Sprinkler heads will be connected with independent range/distribution pipes connected with common feed pipe. The common feed pipes shall be not less than 65 mm. dia.

9.4.7 Obstruction below Sprinklers:- Sprinklers shall be fitted under the following types of obstruction Which are either

- (a) More than 0.8 m. wide and less than 150 mm. from the adjacent walls or partitions.
- OR
- (b) More than 1 m. wide.

9.4.8 Pipe Sizing and Design:- Sprinkler heads located as per para 9.4.3 to 9.4.7 shall be connected with pipe lines permanently charged with water. Depending upon location of sprinkler heads and site conditions, sprinkler heads will be connected with range and distribution pipes.

The pipes connecting the sprinkler heads are to be sized depending upon number of sprinkler Heads and arrangement of their connection. Various pipes connecting the sprinkler heads are termed as

Below.

- (a) Range pipe.
- (b) Distribution Pipe.
- (c) main Distribution Pipe.
- (d) Riser.

Sizes of pipes are to be calculated from various tables and hydraulic calculation given in IS:15105. Some guide lines are given below.

- (i) Pipe less than 25 mm. dia is not to be used.
- (ii) there shall not be more than 6(six) sprinklers in any range.
- (iii) Range and distribution pipe nominal sizes are to be selected from Table 9.1 and 9.2 respectively.

Size of pipes are to be calculated from various tables and hydraulic calculations given in IS:15105. Some guide lines are given below.

**TABLE 9.1
RANGE PIPE NOMINAL SIZES FOR VARIOUS PIPE LAYOUTS IN MODERATE
HAZARD INSTALLATIONS**

	Range Pipe Layout.	Pipe Nominal Bore (mm)	Maximum Number of Sprinklers to be fed by Pipe
	(1)	(2)	(3)

(a)	Ranges at remote end of each distribution Pipe spur:	25	1
	(1) Last two ranges in two end-side layout.	32	2
	(2) Last three ranges in three end-side layout.	25	2
	(3) Last ranges in all other layouts.	32	3
		25	2
		32	3
		40	4
(b)	All other ranges	25	3
		32	4
		40	6

**TABLE 9.2
DISTRIBUTION PIPE NOMINAL SIZE IN MODERATE HAZARD INSTALLATIONS AND MAXIMUM
NUMBER OF SPRINKLERS.**

Pipe Layout	Distribution Pipe Nominal (mm)	Maximum Number of Sprinklers to be fed by Pipe Size listed
(1)	(2)	(3)
(a) Two end side	32	2
	40	4
	50	8
	65	16

(b) All other types	32	3
	40	6
	50	9
	65	18

Typical pipe sizes for sprinkler installation have been shown as above.

9.4.9 Components of sprinkler system:- Following types of valves are used in the installations.

- (a) Stop Valve.
- (b) Test Valve.
- (c) Drain Valve.
- (d) Flushing Valve.
- (e) Check Valve.
- (f) Installation Valve and Alarm Valve.
- (g) Pre action valves.
- (h) Subsidiary valves.
- (i) Alarm Device.
- (j) Pressure Gauges.

The location of above valves shall be as under.

9.4.9.1 Main Stop Valve:- Only one main stop valve shall be provided immediately after main alarm valve at a location which is readily accessible.

9.4.9.2 Test Valve:- For testing hydraulic alarm or electric alarm by drawing water from down stream Side, test valve shall be connected with down stream of the water flow alarm.

9.4.9.3 Drain Valve:- for drainage of system, drain valve 50 mm. dia shall be provided down stream of Installation valve/stop valve or any subsidiary stop valve.

A common valve can perform the functions of test drain. The outlet shall be connected with a 50mm dia G.I. drain pipe along with riser pipes.

9.4.9.4 Flushing valve:- If the water used for sprinkler is not portable, flushing valves shall be provided at the end of a distribution pipe. The valve size shall be same as distribution pipe. Valve outlet shall be fitted with a brass plug and extended to not more than 3 m. above floor.

9.4.9.5 Subsidiary Stop Valve:- Subsidiary stop valve which shall be of the same dia as the pipe line in Which they are fitted shall be provided to control water supply to sprinklers of highly sensitive areas like computer rooms.

- 9.4.9.7 Installation and Alarm Valve:- A sprinkler installation shall be fitted with suitable main Installation valve to control water supply to the installation. The valve set shall comprise of Following:-
- (a) a main stop valve.
 - (b) an alarm valve.
 - (c) a water monitor alarm gong.

The main stop valve shall be placed in the vicinity of the main entrance of the protected area at an easily accessible place. The valve shall be secured open by a pad locked and protected against damage. A location plate shall be fixed near the valve bearing the following words in raised letters.

SPRINKLER STOP VALVE

Alarm valve shall be fitted on the main supply pipe immediately after the main control valve and before any connection is taken off to supply any part of the installation.

- 9.4.9.8 Alarm Device :- Water monitor alarm suitable for sprinkler service shall be provided very close to the installation and alarm valve. This alarm shall be provided on the out side of an external wall. Strainer shall be fitted between the motor nozzle and the alarm valve connection. The water outlet shall be positioned so that any flow of water can be seen. The alarm device shall provide audibility level of 85 dB above the back ground noise level.

- 9.4.9.9 Pressure Gauges :- Pressure gauges shall be provided at each of the following points.

- (a) Immediately down stream of the alarm valve.
 - (b) Immediately up stream of the main stop valve.
- Stop cock shall be provided before pressure gauges for removal without interruption of water supply of the installation. Pressure gauges shall be as per IS:3624.

9.5 SPRINKLERS TYPE

Sprinklers shall be as per IS : 9972 and following types

- 9.5.1 According to type of discharge
- (a) Conventional pattern.
 - (b) Spray Pattern.
 - (c) Side wall pattern.
- 9.5.2 According to mounting pattern.
- (a) Pendent sprinkler.

- (b) Up right sprinkler.
- (c) Horizontal sprinkler.
- (d) Ceiling sprinkler.

9.5.3 According to Release Mechanism.

- (a) Fusible element sprinkler.
- (b) Glass bulb sprinkler.

9.5.4 According to Orifice Size.

- (a) 10 mm.
- (b) 15 mm.
- (c) 20 mm.

9.5.5 According to Temperature Rating.

Sprinkler shall have one of the following temperature rating and shall be correspondingly Colour coded.

(a) Fusible Link Type

<u>Temp. Rating °C</u>	<u>Colour Code</u>
68/74	Natural.
93/100	White.
141	Blue.
182	Yellow.
227	Red.

(b) Glass Bulb Type

<u>Temp. Rating °C</u>	<u>Colour of bulb</u>
57	Orange.
68	Red.
79	Yellow.
93	Green.
141	Blue.
182	Marune.
<u>204/260</u>	<u>Black.</u>

9.6 **SELECTION OF TEMPERATURE RATING**

Temperature rating of a sprinkler should not be less than 30⁰C more than the highest anticipated temperature of the location of installation. Under glazed roofs or where there are roof sheets of PVC or similar plastic material, sprinkler shall be rated 79⁰ C to 100⁰ C.

9.7 **SELECTION OF ORIFICE SIZE**

In moderate hazard application, sprinklers of orifice size 15 mm. shall be used.

9.8 SIZE OF INSTALLATIONS

The number of sprinklers in an installation (excluding sprinklers provided in concealed spaces) not exceed 1000 Nos. as far as possible one area shall be controlled by one installation and alarm valves should be planned. Details of area controlled by installation valves shall be exhibited near the installation valves.

If there are more than one block in a campus, each block shall be provided with different Installation and alarm valve.

9.9 PROTECTION OF SPRINKLERS

Any sprinkler installed in a position of risk or accidental damage shall be fitted with a metal guard suitable for sprinkler service.

9.10 WATER SUPPLY ARRANGEMENT FOR SPRINKLER

9.10.1 Pump- Details of pumps to be installed for sprinkler installation are given in Appendix 'A'. For large installations, separate jockey pump shall be provided for sprinkler system. All pumps shall have common discharge header. If two electrical pumps are to be provided one non-return valve shall be provided in the header such that sprinkler pump will not feed other system.

Separate electrical panel with independent power supply from sub-station shall be provided. The system controller shall be suitably modified to include operation of second electrical pump. In para 2.4.1.14.2 following will be added.

- (a) Sprinkler pump will start on pressure loss (about 1 kg/cm²) in the sprinkler header.
- (b) If sprinkler pump does not start in pre set time or fails during operation, the , main electric fire Pump shall start and feed water to sprinkler system.
- (c) Diesel pump will start and feed water only in case supply to main electric pump is not available or within a pre set time the main electric pump fails to start or fails to start or fails during operation. No other pump will be working when diesel pump is in operation. Audio-visual alarm shall be available to indicate failure of both sprinkler and main electric pump.

9.10.2 water Storage Tank- The water storage tank shall be combined for other fire fighting system and Sprinkler installation and capacity shall be as given in Appendix 'A'.

9.11 SPRINKLER ANNUNCIATION PANEL AND ALARM

Electrically operated alarm shall be provided for indication of operation of sprinkler in an area. Water flow switches shall be installed in main distribution pipes which shall be wired to sprinkler annunciation panel. In the event of operation of a sprinkler, the flow switch will operate and give

signal to the annunciation panel to indicate operation of sprinkler in the area. This will initiate an electrically operated alarm. The system shall be independent of fire alarm system.

9.11.1 Construction Details

- (i) The panel shall be fabricated out of less than 1.6 mm thick MS sheet and powder coated after 7 tank treatment process and shall be totally enclosed dust damp and vermin proof. Suitable knockout shall be provided for the entry of cables. The panel shall be designed such that the equipment for power supply, battery charging are housed in independent compartments. Sealed maintenance free batteries shall also be accommodated inside the panel.
- (ii) indicating lamps control switched, buttons and fuses shall be suitably located in the front and properly labeled.
- (iii) The indicating lamps shall be LED type of following colours. The flow switch operation Conditions shall be indicated by twin lamps.
 - (a) Red to indicate flow switch operation.
 - (b) Amber to indicate fault condition.
 - (c) Green to indicate healthy condition.
- (iv) The test button to test the indication lamps shall be provided.
- (v) The panel shall be solid state type or microprocessor type as indicated in the tender.
- (vi) The primary function of the panel shall be to respond automatically to the operation of one Or more flow switches to give alarm and to indicate area/areas where the device has activated. The operation of one more flow switches shall result in simultaneous alarm given by the following:-
 - (a) External alarm hooter(s).
 - (b) A visible indication on panel.
 - (c) Audio alarm on panel itself (common for all zones.)
- (vii) The panel shall indicate the fault within the system and immediate fault warning shall be given by an audible and visible signal on the panel in case of open circuit, short circuit and earth fault in cable between flow switch and annunciation panel.
- (viii) The panel shall be complete with mimic diagram for the areas covered by different flows switches. The layout of mimic diagram shall be got approved from Engineer-in-Charge.
- (ix) Battery backup with trickle cum boost charger shall be provided for operation of the

System. Indication of mains failure and low battery voltage shall be provided. The batteries shall be sealed maintenance free. The capacity of the battery shall be 12 volt 2 Nos. 24 AH each. All standard accessories shall be provided.

9.12 INSTALLATION

The installation shall be carried out as per Chapter 7 and 11 . Following additional point are to be taken care for sprinkler installations.

- 9.12.1** For fixing sprinkler heads, 15 mm. dia M.s. socket is to be welded to range pipes at the locations As per drawings. Dead plug shall be fixed in the socket.
- 9.12.2** If sprinkler head is to be provided away from range pipe, M.S. pipe nipple of suitable size be used to extend the sprinkler head and socket is welded at desired location.
- 9.12.3** After completion of work in sections, pressure testing at 7.5 kg/cm^2 pressure shall be carried out For 24 hrs.
- 9.12.4** After completion of the entire work, pressure testing of entire pipe work shall be carried out for 24 hrs. at a pressure of 7.5 kg/cm^2 . The drop of pressure up to 0.5 kg/cm^2 shall be accepted.
- 9.12.5** The lines shall be flushed before completion of building work so that any foreign matter which Might have entered the system is taken out. The pressurization pump (jockey pump) be Operated and valves opened at different locations.
- 9.12.6** During occupation of the building, sprinkler heads shall be provided in place of dead plugs. Taflon tape shall be used on threaded portion. The sprinkler heads shall be properly tightened in the socket.
- 9.12.7** When all sprinklers heads are installed, pressure is built up in the system by pressurization pump slowly and in case no leak is found, desired pressure is developed and maintained. In case any leak is detected, the same shall be attended before pressuring the system further.

9.13 COMMISSIONING

As soon as the work is complete, the system shall be commissioned and made available for use In accordance with para 11.6.

CHAPTER-10

ELECTRICAL WORK

10.1 SCOPE

The chapter covers the requirements for the electrical works associated with fire fighting Installation, namely, motors, switch board, power cabling, control wiring, earthing and Remote control-cum-indicating panels.

10.2 GENERAL

- (i) Unless otherwise specified in the tender specifications, all equipments and materials for electrical work shall be suitable for operations on 415 V / 240 V \pm 10 % (3 phase/single phase), 50 Hz. AC system.
- (ii) All electrical work shall be carried out complying with the Indian Electricity Rules, 1956 as amended to date.
- (iii) All parts of electrical works shall be carried out as per appropriate CPWD General Specifications for Electrical works, namely, part I (Internal) 2005, part II (External) 1994 work, and part IV (Sub-station), 1982 all as amended to date.
- (iv) All materials and components used shall conform to the relevant IS specifications amended to date.

10.3 POWER SUPPLY

Following 3 phases, 415 Volts, 50 Hz., supplies shall be made available for fire fighting Installations directly from sub-station.

- (i) Normal supply for fire pumps near under ground tank.
- (ii) Essential supply for terrace pump.

In buildings where power failures are likely to be for long duration, in order to facilitate Operation of jockey pump and maintain pressure in the system, essential supply for jockey Pump and control for diesel engine shall be made available in the pump house.

10.3.1 Power cable of adequate size shall be laid from the sub-station directly to the switch board of above pumps. Independent supply shall be provided for water supply pumps if installed in the same pump house. The power supply for fire fighting is not to be used for any other purpose.

10.3.2 If the fire pump house, is away from the sub-station building, the route of the cable shall not Pass under the building or permanent structure. Cable shall be laid along the route which is safe from fire.

10.3.3 Sufficient spare power shall always be available to drive pumping sets at all times throughout the year. Suitable capacity ACB/MCCB/Fuse Switches/Switches shall be provided in the electrical panel for extending supplies to fire pumps. Such switches shall be suitably Marked with "FIRE SWITCH" and shall not be switched off without permission/intimation to appropriate authority. In case any maintenance work is to be carried out on the electrical panel where from supplies to fire pumps have been extended, alternative arrangement shall be made to ensure that power supply to fire pumps continue to be available any time.

10.4 MOTORS

The motors shall be squirrel cage AC induction type. The motors shall be suitable for continuous duty and rating necessary to drive the pump at 150 percent of its rated discharge with at least 65 percent rated head. The motor shall be totally enclosed fan cooled type confirming to protection clause IP 21 of IS : 4691. The class of insulation shall be 'F'. The synchronous speed shall be 1500/3000 rpm as per requirement of the pump. The motor shall conform to IS:325.

10.5 MOTOR STARTER

- (i) The motor starter shall conform to IS: 1822 "Motor starters of voltage not exceeding 1000 volts" and shall be air insulated and suitable for 415 V, $\pm 10\%$, 50 Hz., 3 phase AC supply and shall be integrated in the panel.
- (ii) Starter for the motor shall be direct on line (D.O.L) for motors up to and including 7.5 H.P. rating and automatic star-delta type for motors of higher ratings unless otherwise specified in the tender specifications.
- (iii) Each starter shall be provided with the following protections:-
 - (a) Thermal overload on all the three phases with adjustable settings,
 - (b) Independent single phase preventor. (current sensing type).
- (iv) Adequate number of extra No/ NC contacts for interlocks, indicating lamps, remote Operation etc. shall be provided on the starter/ contractor.
- (v) Under voltage / No volt trip shall not be provided.

10.6 SWITCH BOARDS

- (i) The main switch board shall be mounted, free standing or wall mounted cubical type and Shall be factory built fabricated by one of the approved switch board manufacturer. The Board shall be fabricated from 2.0 mm. thick CRCA sheet and powder coated after 7 tank

treatment process. The board shall be fabricated with IP 42 degree of protection. It shall be suitable for termination of the incoming cable (s) from bottom.

- (ii) The capacity of switch gear shall be suitable for the requirements of motor fed/ controlled. Starting currents shall be duly considered.
- (iii) Switch fuse units shall be used upto and including 32 A and SDFU shall be used for 63 A and above. ACB shall be used for 630 A and above ratings. Alternatively MCCBs of appropriate fault level will be provided.
- (iv) All switch fuses/ SDFU shall be of AC 23 duty as per IS: 4064-1978 as amended upto date . They shall be complete with suitable HRC cartridge type fuses.
- (v) Switch boards shall house starters for motors with independents current sensing type Single phase preventor for each starter.
- (vi) Volts meter with selector switch, a set of indicating lamps and fuses for voltmeter and lamps shall be provided. Ammeter with CTs, and selector switch shall be provided with each motor starter. Instruments shall be flush mounted with the panel and have a class index not higher than 1.0. the instruments and accessories shall be provided whether or not specifically indicated in the tender specifications.
- (vii) The fabrication of switchboards shall be taken up only after the drawings for the Fabrication of the same are approved by the Engineer-in-charge.
- (viii) Switchboards shall be fabricated as per specifications indicated in sub-para above.
- (ix) The layout shall be designed for convenient connections and inter-connections with the Various switchgear. Connections from individual compartments to cable alleys shall be Such as not to shut down healthy circuits in the event of maintenance work becoming Necessary on a defective circuit.
- (x) Care shall be taken to provide adequate clearances between phase bus bars as well as between phase bus bars, neutral and earth.
- (xi) Where terminations are done on the bus bars by drilling holes therein, extra cross Section shall be provided for the bus bars. Alternatively, terminations will be made by Clamping.
- (xii) Provision shall be made for proper termination of cables at the switchboards such that there is no strain either on the cables, or on the terminators. Cables connected to the upper tiers shall be duly clamped within the switchboards.
- (xiii) Identification labels shall be provided against each switchgear and starter Compartment, using plastic/aluminium engraved labels.

- (xiv) Metallic danger board conforming to relevant IS shall be fixed on each electrical Switchboards.

10.7 SYSTEM CONTROLLER

For controlling operation of pumps as per para 2.4.1.14 and indicating fault, system controller

shall be provided. The system controller shall consist of relays timer, contactors etc and shall

be designed to operate the fire pumps with interlocking and fault indication as described in

para 2.4.1.14. Annunciation window shall be provided to indicate following faults.

- (i) Low water level in UG tank.
- (ii) Low water level in terrace tank.
- (iii) Main pump failed to start.
- (iv) Main pump failed during operation.
- (v) Diesel pump failed to start.
- (vi) Diesel pump failed during operation
- (vii) Supply to main pump failed
- (viii) Supply to Pressurization pump failed
- (ix) Supply to Terrace Pump failed.

Suitable sensors. Differential pressure switches, monitors shall be provided at respective

Location. The control system shall be operational on 12 volt/24 Volt DC batteries remain

Charged. Batteries shall be sealed maintenance free type.

10.8 REMOTE INDICATING PANEL

- (i) The remote indicating panel shall be provided in the fire control room. This panel shall have

necessary status indication of all electric motors.

- (ii) Back indication to show the status of operations of all the motors and also pressure in the System, water level in under ground and over head tank etc. shall be provided.
- (iii) Panel shall be fabricated from not less than 1,6 mm thick CRCA sheet and powder coated after 7 tank treatment process. The panel shall be dust, damp and vermin proof. This shall be of wall mounting type. This shall be complete with necessary termination arrangements, multicore cables, tag blocks, control transformer, designation plastic labels, double earth studs etc. as required.

10.9 POWER CABLING

- (i) Unless otherwise specified, the power cables shall be XLPE insulated, PVC outer sheathed aluminium conductor, armoured cables 1100 V grade. The power cables shall be of 2 core for single phase, 4 core for sizes upto and including 25 sq.mm, 3-1/2 core for sizes higher than 25 sq. mm for 3 phase. Alternatively, XLPE/PVC insulated copper cable(single core/multicore un- armoured) of grade 1100 V shall be used.
- (ii) Power cables shall be of as approved by the Engineer-in-Charge. After taking into consideration the load, the length of cabling.
- (iii) Cables shall be laid in suitable metallic trays suspended from ceiling, or mounted on walls. Cable ducts shall not be provided in pump rooms. Cable trays shall be of perforated steel Sheet with adequate structural strength and rigidity. Necessary supports and suspenders For cable trays shall be provided by the contractor as required.

10.10 CONTROL WIRING

- (i) Control wiring shall be done using ISI Marked PVC insulated and PVC sheathed, 2.5 sq.mm, 250 V grade, armoured multi-core copper conductor cable. The control cable shall also be laid in the same manner as power cable.
- (ii) The number and size of the control cables shall be such as to suit the control system design adopted by the contractor.
- (iii) Runs of control wires within the switchboard shall be neatly bunched and suitably supported/ Clamped. Means shall be provided for easy identification of the control wires.
- (iv) Control wiring shall corresponds to the circuitry/sequence of operations and interlocks approved by Enigneer-in-Charge.

10.11 EARTHING

- (i) Provision of earth electrodes and the type of earthing shall be as specified in the tender Specifications.
- (ii) The earth work shall be carried out in conformity with CPWD Specifications for Electrical Work (part-I), Internal 2005.
- (iii) Metallic body of all motors, medium voltage equipments and switch boards shall be Connected by two separate and distinct earth conductors to the earth stations of the Installation. Looping of such body earth conductors is acceptable from one equipment, or Switch board to another.
- (iv) The size of earth conductors for body earthing of equipments shall be 2 Nos. 6 mm dia Copper wire/2 Nos. 25 x 3 mm G.I. strip.
- (v) Armouring of cables shall be connected to the body of the equipments/switch board at both the ends. Compression type glands shall be used for all such terminations in the case of PVC cables.

10.12 PAINTING

All panels shall be supplied with the manufacturer's standard finish painting or as indicated in the Schedule of work.

CHAPTER-11
INSTALLATION, TESTING AND COMMISSIONING

11.1 SCOPE

The chapter covers the requirement of installation, testing and commissioning of fire fighting system.

11.2 PREPARATION AND APPROVAL OF DRAWING

On award of the work, the contractor has to prepare working drawings as per para 1.17.2 and Submit to the Engineer-in-charge for approval. The work is to be executed as per approved drawings. The stage of approval of drawings is therefore approval. The requirements of various components of fire fighting system have been described in previous chapters dealing with the components. However generally following points are to be taken care while examining and approving the drawings.

11.2.1 Site survey should be carried out in detail.

11.2.2 In addition to building plans, layout plan along with landscape plan/horticulture plan and Other services plans should be consulted while deciding route of under ground pipes from Pump house and around the building.

11.2.3 As far as possible, under ground pipe are not to be laid under road, pavement, building and long open spaces. The locations along road, foot path in earth will be preferred.

11.2.4 The location of yard hydrants, fire service inlet and fire service connection are to be decided based on consideration of para 2.4.1.8 to para 2.4.1.10. however necessary adjustments are to be made so that these components do not become hindrance in vehicular movements and entrance to the building. Requirement of other building services are also to be given due consideration. Symmetry should be maintained for aesthetic considerations.

11.2.5 Pipe sizes are to be decided in accordance with provision of para 2.4.1.2 and 4,5,2.

11.2.6 Pump House:- The layout of equipment in pump house is very important from operation and maintenance considerations. The requirement of pumps and engine have been described in Chapter 5 and 6. In case other equipment's i.e. water supply pumps etc are to be installed in the same pump house, sufficient space shall be left for them as well. The dimensioned foundation drawing of pumps should be available for Marking in the pump room layout. The layout is to be prepared in such a way that it should be possible to maintain any equipment without disturbing the adjoining equipment. Electrical panels are to be installed at a location which is easily accessible near the entrance to the pump house and there should be no

possibility of water dripping over or near the electrical panel.

- 11.2.7 Terrace Pump:-** The location of pumps and terrace pipe will be decided keeping in view location of terrace tanks for fire fighting and other services. The pipe line should not cause undue hindrance for movement of maintenance personnel at the terrace.
- 11.2.8 Electrical Panel:-** Complete wiring drawing, layout etc. are to be examined to ensure that Provisions of agreement are incorporated in the drawing. Sizes of various panel and mounting arrangement will be decided keeping in view ease of operation and aesthetic consideration as well.
- 11.3 INSTALLATION:-**
The requirement of installation of various components have been described in previous Chapters. However following precautions are to be taken during execution of the work.
- 11.3.1** The pump and motor/engine are to be perfectly aligned on the base plate so that there is no Vibration during operation. All nuts, bolts, washers shall be of adequate size and galvanized.
- 11.3.2** The pipe supports should be decided in way that the weight of pipes and valves are not transferred to the pumps and supports do not cause hindrance in movement inside the pump house. As far as possible, floor supports will be provided in pump house.
- 11.3.3** All valves shall be installed at height and in a position that their operation by right hand is Conveniently possible.
- 11.3.4** All pressure gauge should be installed so that the dial is vertical and is visible while entering the pump house.
- 11.3.5** Electrical panels should not be installed at floor level. The panels shall be sufficiently raised above ground level. If panels are to be mounted on wall, an angle iron frame shall be provided so that atleast 75 mm space is left behind the panels. The panels shall be easily approachable.
- 11.3.6** Cable trays are to be used for laying of power and control cable inside pump house. No cable is to be laid at floor level/in trench. Cable tray layout should give neat appearance. All cable tray shall be adequately supported from the ceiling/floor.
- 11.3.7** Drain pump shall be installed in the sump provided as per para 3.2.2 (viii). The pump shall Operate automatically for which water level sensor shall be provided.
- 11.3.8** In no case any structural member i.e. RCC wall, column, beam and floor are to be damaged during installation. Mechanical fasteners are to be used for grouting support. U.G. tank wall is not to be used for any support. No pipe/cable is to cross the pump house below ground level. are only to be used for this purpose.
- 11.3.9** The engine installation work shall be carried out in accordance with the requirement of engine

Manufacturer and be got approved by the manufacturer or their authorized service centre. the exhaust pipe should be suitably extended out side the pump house so that smoke does not effect nearby structure. Fuel tank shall be properly supported and located in away that the same does not cause hindrance in movement in the pump house.

- 11.3.10** While excavating for laying of external pipes, suitable sign board/barricading shall be provided to ensure that no person falls in the trench.
- 11.3.11** The width and depth of trench shall be adequate for laying the pipe 1 m below ground level.
- 11.3.12** No earth or any other matter is to be allowed to enter the pipes. The ends shall be kept closed Always.
- 11.3.13** The anticorrosive treatment is to be applied on the entire length laid under ground in accordance with para 7.12. The treatment is not to be damaged.
- 11.3.14** Pressure testing is to be carried out in sections before filling the earth back in the trench.
- 11.3.15** The earth filling is to be done in layers of 20 cm each and properly rammed so as to avoid Possibility of settlement. Surplus earth/ melba shall be removed from the site by the Contractor.
- 11.3.16** Where pipes crossing road likely to have heavy traffic, additional protection over pipe shall be provided to ensure that pipe is not damaged.
- 11.3.17** External hydrants and fire service connection/ inlet shall be parallel to the nearby road/ foot Path so as to give proper appearance. Foundation shall be raised from below ground level and shall be properly plastered in plumb. The hydrants shall be facing the road/ approach. There shall be no obstruction in approaching the hydrants for operation.
- 11.3.18** Risers shall be parallel to the wall and in plumb. Adequate supports shall be provided from the wall. Opening around the pipe in slab shall be filled with CC and finished with plaster.
- 11.3.19** Internal hydrants shall be provided in the centre and facing ou side for ease of operation. Sufficient space shall be provided around the handle for operation. There shall be no hindrance in moving the first aid hose reel.
- 11.3.20** Terrace pipes shall be supported on CC pedestals of adequate height. The pipe route shall be Such as no hindrance is created in movements at the terrace. Pipes shall be sufficiently Raised above terrace. It is to be ensured that water proofing is not damaged during laying of Pipes.

11.4 TESTING

11.4.1 Initial Testing

11.4.1.1 During laying of pipes, the same shall be subjected to 10 kg./cm² hydraulic pressure for a Period of 24 hours, in sections.

11.4.1.2 After completion of the work, all valves/ fittings shall be installed in position and entire System shall be tested for 24 hours at a pressure of 10 Kg/ cm². The drop of pressure up to 0.5 Kg/cm² shall be accepted.

11.4.2 Final Testing

11.4.2.1 After completion, all operation checks as per para 2.4.1.14 shall be carried out for automatic operation of the systems. For this purpose, landing valve will be opened at different locations. The exercise shall be repeated couple of times to ensure trouble free operation of the system.

11.4.2.2 **Flow Test :-** The design flow of pumps shall be checked. The pump shall be operated after opening a number of lading valves at different locations. Design pressure is to be maintained in the pump house. Water discharge is to be measured by drop in level in UG tank for a certain period. All pumps shall be tested one by one. The flow rate shall be not less than as specified while maintaining the design pressure in pump house.

11.5 INSPECTION

After completion of the work and testing to the entire satisfaction of Engineer-in-Charge, the Installation shall be offered for inspection by Chief Fire Officer or his representative. Testing as desired by the fire officer shall be carried out. The contractor will extend all help including manpower during testing. the observation of Chief Fire Officer which are a part agreement shall by attended by the contractor. Nothing extra is to be paid for testing as above.

11.6 COMMISSIONING

11.6.1 **Flushing the System :-** Before commissioning. The entire system shall be flushed to ensure That any earth / foreign matters which have entered during installation are taken out. For this, pump will be operated and valves opened at different locations.

11.6.2 As soon as the work is complete, the system shall be commissioned and made available for Use. Requirement of fire fighting installations is equally important during occupation of the building. If the building is to be occupied in part, fire fighting system of under construction by isolating the system of under construction portion of the building.

11.6.3 The fire fighting system shall be maintained and manned from the very first day of its Commissioning.

11.6.4 Any defects noticed during the warranty period shall be promptly attended by the Contractor and availability of the system at time is to be ensured.

APPENTIX A

REQUIREMENT OF FIRE FIGHTING INSTALLATION (AS PER NBC-2005)

S.NO	Type of Building Occupancy	Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler	Capacity		Pump capacity Type, Number	
							UG Tank liters	Terrace Tank liters	Near UG Tank IPm	Near Terrace Tank
1	2	3	4	5	6	7	8	9	10	11
(1)	Residential (i) Less than 15 m in height.	R	NR	NR	NR	NR	NR	5000 (5000)	NR	450 (450)
	(ii) 15 m and above but not exceeding 35 m in height.	R	NR	R	NR	NR	NR	25000	NR	900
	(iii) Above 35 m But not exceeding 45 m in height.	R	R	NR	NR	NR	75000	5000 (5000)	1620lpm (E-1) (D-1)	NR
	(iv) Above 35 m but not exceeding 60 m in height.	R	R	NR	R	R	0	10,000	2280lpm E-1 D-1	NR
	(v) Above 60 m in height.	R	R	NR	R	R	100,000	25,000	2280 lpm E-1 D-1	NR

(2)	Educational (Other than s)									
	(i) Less than 15 m in height.									
	(a) Ground plus one storey	NR	NR	NR	NR	NR	NR	5000(*)	NR	450(*)
	(b) Ground plus two or more storeyes	R	NR	NR	NR	NR	NR	10,000 (5000)	NR	450 (450)
	(c) 15m. and above but not exceeding 30 m in height	R	NR	R	NR	NR	NT	25000	NR	900
(3)	& Nursing Home.									
	(i) Less than 15 m In height with area upto 1000 m ²									
	(a) Upto ground Plus one Storey no beds	R	NR	NR	NR	NR	NR	2500 (2500)	NR	NR
	(b) upto ground Plus one Storeys with beds	R	NR	R	NR	NR	NR	5000 (5000)	NR	450 (450)
	(c) Ground plus Two or more Storeys with Beds.	R	NR	R	NR	NR	NR	5000 (5000)	NR	450 (450)
	(d) Ground plus two or more storeys with beds	R	R	NR	NR	NR	50,000	5000 (5000)	1620 lpm E-1 D-1	NR

	(ii) Less than 15 m In height with Plot area more Than 1000 m ²	R	R	NR	R	NR	100000	10000	1620 lpm E-1 D-1	NR
	(iii) 15 m. and above but not exceeding 24 m in height	R	R	NR	R	R	100000	20000	2280 lpm E-1 D-1	NR
	(iv) Above 24 m but not exceeding 30 m in height.	R	R	NR	R	R	150,000	20,000	2280 lpm E-2 D-1	NR
(4)	Assembly Building. (i) Less than 10 m in height									
	(a) upto 300 persons	R	NR	R	NR	NR	NR	10,000 (5000)	NR	450 (450)
	(b) More than 300 persons	R	NR	R	NR	NR	NR	15,000 (5000)	NR	900
	(ii) Above 10 m but not exceeding 15 m in height.	R	R	NR	NR	NR	50000	5000 (5000)	2280 lpm E-1 D-1	450 (450)
	(iii) Above 15 m But not exceeding 24 m in height.	R	R	NR	R	R	75,000	10,000	2280 lpm E-1 D-1	NR
	(iv) Above 24 m but not exceeding 30 m in height.	R	R	NR	R	R	100,000	20,000	2280 lpm E-2 D-1	NR
(5)	Business Building (i) Less than 10 m in height	R	NR	R	NR	NR	NR	10,000 (5000)	NR	450 (450)

	(ii) Above 10 m but not exceeding 15 m In height	R	R	NR	NR	NR	50000	5000 (5000)	2280 lpm E-1 D-1	450 (450)
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	(iii) Above 15 m but not exceeding 24 m in height	R	R	NR	R	R	75,000	10,000	2280 lpm E-1 D-1	NR
	(iv) Above 24 m but not exceeding 30 m in height	R	R	NR	R	R	100,000	20,000	2280 lpm E-2 D-1	NR
	(v) Above 30 m in height	R	R	NR	R	R	200,000	20,000	2850 lpm E-2 D-1	NR

Legend :

- R- Required to be provided
 NR- Not required to be provided
 E-1- One electrically operated main fire pump.
 E-2- Two electrically operated main fire pump.
 D-1- One diesel engine main fire pump.

Note:

- (1) (*) To be provided if basement area exceeds 200 m²
 (2) Value given in parenthesis shall be added if basement area exceeds 200 m²
 (3) The buildings indicated in Col.(2) shall include the following buildings.

(A) Residential Buildings : Apartments, Dormitories, Hostels, Barracks
 (Does not include Hotels.)

(B) Educational : Schools and Institutions.

(C) and Nursing Home : , Nursing Home, Sanatoria.

(D) Assembly Buildings : Buildings used for Recreations, Social, Religious,
 Purpose e.g. Theatre, Motion picture Houses,

Assembly Hall, Auditorium, Exhibition Hall,
Auditorium, Exhibition Hall, Museum, Restaurant,
Place of Worship, Station, Terminals of Air etc.

(E) Business Buildings : Office, Banks, Professional Establishments,
Laboratories, Research Establishments,
Libraries, Test House, Computer installation,
Telephone Exchanges etc.

(4) Buildings at B.C and D in note 2 are not permitted more than 30 m. in height.

(5) **Automatic Sprinkler** : Automatic Sprinkler shall be provided in basement if area is 200 m² and above.

(6) Typical system with one electric and one diesel fire pump shall be as shown in Fig 1 and 3

(7) Typical system with two electric and one diesel fire pump shall be as shown in Fig 2 and 4.

APPENDIX - B

TERMINOLOGY

For the purpose of this specification, the following definitions shall apply.

1. **Static Water Tank** : Underground or surface water tank, constructed to store water for fire fighting Purpose.
2. **Terrace Tank** : A concrete/masonry/plastic steel tank constructed or erected on terrace of building For fire fighting purpose.
3. **Priming Tank** : A small tank erected in/over the pump house above the fire fighting pumps to keep the pump casing and suction of the fire pump permanently flooded.
4. **Foot Valve** : A valve fixed in the suction strainer of the fire pump which opens only inwards to allow in-rush of water into the pump suction and fire pump when the fire pump is actuated automatically /manually.
5. **Jockey Pump** : A pump of small capacity which is set to come into operation, automatically with drop in static pressure in the system and to automatically stop when the non-return valve on delivery side.
6. **Terrace Pump** : An electricity driven pump, located on the terrace connected to a terrace tank with gate valve on suction side and to the internal hydrant system with non-return valve on delivery side.
7. **Fire Pump** : An electric/diesel pump installed at static water tank to charge the wet riser system.
8. **Stand-by Pump** : A pump of same capacity as fire pump, driven by a diesel engine or connected to any other alternate source of electric supply.
9. **Pump Panel** : Panel comprising starting, stopping and indicating devices of fire pumps.
10. **Dry Riser** : An arrangement of fire fighting within the building by means of vertical rising mains not less than 100 mm. internal dia with landing valves on each floor/landing which is normally dry but is normally dry but is capable of being charged with water usually by pumping from fire service appliances.
11. **Down-Comer** : An arrangement for fire fighting within the building by means of down-comer mains of not less than 100 mm internal dia, connected to terrace tank through terrace pump, gate valve and non-return valve and landing valves on each floor/landing. It is also fitted with inlet connections at ground level and air release valve at roof level for being capable of charged with

water by pumping from fire service appliances.

12. **Wet-Riser-cum-Down Comer** : An arrangement for fire fighting within the building by means of Vertical rising mains of not less than 100 mm. internal dia with landing valves on each floor/ landing connected to terrace tank for fire fighting purpose, through a terrace pump, gate valve and non-return valve near the tank and to a fire pump, gate and non-return valves, over the static tank.
13. **Wet-Riser** : An arrangement for fire fighting within the building by means of vertical rising mains of not less than 100 mm. internal dia with valves on each floor/landing for fire fighting purposes and permanently charged with water from a pressurized supply.
14. **Landing valve** : An assembly comprising valve (s) and outlet (s) connections from a riser system.
15. **Hose reel** : Fire fighting equipment, consisting of a length of tubing fitted with a shut-off nozzle and connected to a reel, with a permanent connection to a pressurized water supply.
16. **Air Release Valve** : A device by which the trapped air inside a riser main is expelled by water as the system is being charged.
17. **Air Vessel** : A cylindrical vessel installed in the wet-riser system at the bottom and top levels to Counteract the water hammer effects.
18. **Pressure Switch** : A switch connected on delivery line of fire pump or in the body of hydro-Pneumatic tank at pre-set pressure level so designed to automatically start the fire pump or Jockey pump, as the case will be, when the pressure in the system falls below the pre-set level.
19. **Fire Service Inlet** : A 2- or 3-way collecting head with non-return valves fitted to the down comer /wet riser main, so that in case of need, fire service can directly pressurize the system with their Pump.
20. **Fire Service Connections:-** This is a 4-way collecting breeching with blank caps (without non-return valve) fixed to a 150 mm dia pipe which is connected to the fire tank for filling from external source.
21. **Automatic Fire Detection and Alarm System:** Fire alarm system comprising components for automatically detecting a fire, initiating an alarm of fire and initiating other actions as appropriate.
22. **Automatic Sprinkler System** : A system of water pipes fitted with sprinkler heads at suitable Intervals and heights, and designed to actuate automatically, control or extinguish a fire by the Discharge of water.
23. **Building, height of.** The vertical distance measured in the case of flat roofs, from the average

Level of the ground around and contiguous to the building or as decided by the Authority to the terrace of the last livable floor of the building adjacent to the external wall; and in the case of pitched roofs, upto the point where the external surface of the outer wall intersects the finished surface of the sloping roof: and in the case of gables facing the road, the mid-point between the eaves level and the ridge. Architectural features serving no other function except that of decorations, shall be excluded for the purpose of measuring heights.

APPENDIX- C

MAINTENANCE AND OPERATION OF FIRE FIGHTING SYSTEM

C.1 INTRODUCTION

This appendix cover suggestive guidelines for maintenance and operation of the Fire fighting System.

C.1.1 Objective :-

- (i) To keep the entire system fully operational and functional at all times.
- (ii) In case full system can not be kept functional for unavoidable reason, as much as Possible, the installation shall be retained functional by isolating the defective section.

C.2 MAINTENANCE REQUIREMENT OF SYSTEM COMPONENTS

For maintaining fire fighting system following points are to be taken care of:-

- C.2.1 To ensure that piping system is free from leakage. Any portion found to be taken all the and to maintain the tanks in clean condition.
- C.2.2 To ensure that the piping system is free from leakage. Any portion found to be leaking is to be isolated, rectified and connected with healthy system in shortest possible time .
- C.2.3 To ensure that all pumps are in good running conditions. Any pump found to be defective is to be isolated by closing valves and attended immediately and put in to service in Minimum time.
- C.2.4 To ensure availability of power for electrical pumps, working of starters, switch gear and Other electrical components.
- C.2.5 To check all landing valves of internal and external hydrants, isolating valves and replace the Defective ones whenever necessary.
- C.2.6 To check automatic operations of entire system by opening landing valves at different locations.
- C.2.7 To conduct fire drill at regular interval.

C.3 PERIODICAL TESTING

For achieving the objectives of para C.1.1 and meeting the requirement of para C.2 periodical testing and checking the system is essential. Various activities and their duration have been

tabulated in table C.1.

C.4 PROCEDURE

- C.4.1 Through the fire fighting system operation is automatic, however for daily checking and Attending to the system in case of operation, a trained pump operator shall be available round round the clock.
- C.4.2 Operation and Maintenance instructions shall be available in the pump room and fire control Room.
- C.4.3 Water for fire fighting purpose is not to be used for any other purpose. However in order to avoid stagnation, the same shall be changed / cleaned regularly.
- C.4.4 Maintaining Diesel Engine is very important for the system operation since during fire, power Supply is deliberately or un-deliberately switched off. Annual maintenance Contract (AMC) of engine shall be given to the authorized service centre of engine manufacturer. Adequate diesel should either be available in the pump house or near by so that operation is not discontinued for want of diesel.
- C.4.5 If any out let is found to be defective and replacement is not easily available the whole assembly should be removed and be replaced by blank off plate so that the system remain operational.
- C.4.6 Hose reels shall be subjected to regular inspection to ensure that all valves are functional, out let nozzle not choked. At least once in a year the same shall be subjected to operation to ensure that hose reel is in good condition and the coupling joints are water tight. Flow should checked for the leakage of hose reel.
- C.4.7 All isolating valves shall be checked for operation. The valves in closed position be opened and closed couple of times and the valves in open position be closed and opened couple of times so that when required , the valves perform their function.
- C.4.8 Hose pipes and their couplings shall be checked to ensure there is no leakage during their use. The female coupling cam tooth mechanism be operated and lubricated for ensuring ease of Operation.
- C.4.9 Power supply to the pump house is not to be discontinued for any reason. Alternative Arrangement shall be made in case any feeding switch gear is under repair / replacement.
- C.4.10 It has to be ensured that there are no obstructions in front of the hydrants impending Accessibility.

C.5 FIRE DRILL

For making the users familiar with the system, fire drill shall be carried out once in six months. Local fire service and nodal officers for, charge of various parts of the building shall be involved in conducting fire drill. Operation of the system shall be demonstrated so that all Users are confident of the system and aware of their duties and responsibilities during fire.

**TABLE C.1
PERIODICAL TESTING AND MAINTENANCE CHART**

Sl.NO	System Components	Activity	Duration
1.	Water Tanks	(i) Level Check	Daily
		(ii) Cleaning	Once in a year
2.	Pumps	(i) Running	Daily
		(ii) Test flow	Annually
3.	Engine	(i) Running	Daily
		(ii) Lubrication	Quarterly
		(iii) Battery	Weekly
		(iv) Fuel Tank	Daily
		(v) Servicing	As per engine manufacturer's recommendations.
4.	Motor	(i) Running	Daily
		(ii) Starter	Weekly
		(iii) Insulation Resistance	Once in a year
5.	Piping	(i) Pressure	Daily
		(ii) Flushing	Once in a year
6.	Valves (Landing and Isolation)	(i) Operation	Monthly
7.	Control System	(i) Operation	Monthly
		(ii) Connection and system components	Quarterly
8.	Hose Reel and Hose Pipes	(i) Physical check	Monthly
		(ii) Operation check	Annually
		(iii) Replacement	Depending upon physical Condition.
9.	Fire Brigade Connections/ Inlet	(i) Physical Check	Monthly
		(ii) Operation Check	Annually
10.	Instantaneous Coupling	(i) Physical check	Monthly
		(ii) Lubrication	Once in Six months.

11.	Painting	(i) Out Door (ii) In Door	Once in a year. Once in two years.
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APPENDIX – D

MAINTENANCE OF AUTOMATIC SPRINKLER SYSTEM

D.1 Maintenance of other fire fighting installation has been described in Appendix- 'C' which hold good for sprinkler installations also. In addition following points shall be taken care.

D.1.1 Sprinkler shall not be re-conditioned or repaired. used and/or defective sprinklers shall be Replaced by new ones.

D.1.2 Sprinklers shall not be painted after installation.

D.1.3 Spare Sprinklers- A stock of spare sprinklers shall be kept in Fire Control Room so that prompt replacement is possible after operation/damage of a sprinkler head. A minimum of 5% of the installed capacity or 25 sprinklers of all types which ever is more shall be kept in stock.

Spanners for sprinkler and taflon tape shall also be kept alongwith spare sprinklers in readiness.

D.1.4 As far as possible, the installation shall be maintained in operating condition by blanking off Pipe work feeding the inoperative part or parts where work is taking place.

D.1.5 The inoperative part, if defective shall be attended to and connected with the operative system.

D.1.6 Action following sprinkler operation

D.1.6.1 Following the operation of sprinklers, the operated head shall be replaced with new ones and Water supply shall be restored.

D.1.6.2 The sprinklers in the vicinity of the operated sprinklers shall also be checked for damage by Heat or any other cause and replaced if necessary.

D.1.6.3 The sprinkler pump shall not be shut off until complete extinguishment of the fire. The starting Of the pump shall be automatic but the stopping of the pump after an extinguishment shall be manual.

D.1.7 All piping shall be examined to determine its conditions at least once a year.

D.1.8 All installation valves and associated equipment shall be serviced and testes annually.

D.1.9 Discharge test of sprinklers shall be carried out at least once in six months.

D.1.10 Manual testing of the system shall be carried out at least once in six months.

D.1.11 When normally opened valves are closed following system operation or test, suitable Procedure shall be instituted to ensure that they are re-opened.

D.1.12 The entire system shall flushed at least once in a year.

D.1.13 The sprinkler bulbs shall be kept free from paint or dust.

D.2 MAINTENANCE GUIDELINES

Following guidelines shall be followed for sprinkler maintenance.

D.2.1 Maintenance and testing shall be carried out in a planned and systematic manner and records Kept.

D.2.2 Only trained personnel shall be engaged in the work. Contract with qualifies agency for service, Test and operation is recommended.

D.2.3 Other fire fighting installations are operated manually i.e. to operate a first aid hose reel or Internal/external hydrant a person is required. As such during fire, when the system is in Operation, somebody in the building is aware of it. In case of sprinkler operation, no one will Come to know. For looking after sprinkler installation following personnel shall be available at all hours.

(a) A trained pump operator shall be available in the pump room.

(b) Depending upon the size of installations at least two or more trained personnel shall be Available in fire control room.

CHAPTER-12

ADDRESSABLE FIRE ALARM SYSTEM:

1.0 GENERAL

1.1 DESCRIPTION:

This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

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.

The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

1.2 SCOPE:

A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

1.2.1 Basic Performance:

Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 6 (Class A) Signaling Line Circuits (SLC).

Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

On Style 6 or 7 (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.

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.

NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.

Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.

NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

Two-way telephone communication circuits shall be supervised for open and short circuit conditions.

2.0 DRAWINGS & TECHNICAL SUBMITTALS

2.1 General:

Two copies of all submittals shall be submitted to the Architect/Engineer for review.

All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers will be substituted for the specified equipment as long as the minimum standards are met.

Z e

For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

2.1.1 Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

Show annunciator layout, configurations, and terminations.

2.1.2 Manuals:

Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

2.1.3 Software Modifications :

Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.

Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.

2.1.4 Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

2.1.5 WARRANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

3.0 APPLICABLE STANDARDS AND SPECIFICATIONS:

3.1 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.

A) National Fire Protection Association (NFPA) - USA:

NFPA 13	Sprinkler Systems
NFPA 16	Foam/Water Deluge and Spray Systems
NFPA 17	Dry Chemical Extinguishing Systems
NFPA 17A	Wet Chemical Extinguishing Systems
NFPA 2001	Clean Agent Extinguishing Systems
NFPA 72	National Fire Alarm Code
NFPA 76	Telecommunication Facilities
NFPA 318	Clean Room Applications
NFPA 101	Life Safety Code
NFPA 90A	Air conditioning & ventilation system

B) Underwriters Laboratories Inc. (UL) - USA:

UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 864	Control Units for Fire Protective Signaling Systems 9th Edition
Listed	
UL 268	A 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 346	Waterflow Indicators for Fire Protective Signaling Systems
UL 1971	Visual Notification Appliances
UL 228	Door Holders

3.2 NATIONAL BUILDING CODES

3.2.1 DELHI FIRE CODES

The Video Display Terminal (VDT) shall comply with Swedish magnetic emission and X-radiation guidelines MPR 1990:10.

3.2.2 APPROVALS:

The system shall have proper listing and/or approval from the following nationally recognized agencies:

Stamp and Signature of the bidder **100**

UL Underwriters Laboratories Inc (9th Edition)

The fire alarm control panel shall meet UL Standard 864 9th Edition (Control Units)

The system shall be listed by the national agencies as suitable for extinguishing release applications. The system shall support release of high and low pressure CO2.

4.0 PRODUCTS

4.1 EQUIPMENT AND MATERIAL, GENERAL:

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

5.0 CONDUIT AND WIRE:

5.1 Conduit:

Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.

Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.

Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions will be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.

Conduit shall be 3/4-inch (19.1 mm) minimum.

5.2 Wire:

All fire alarm system wiring shall be new.

Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.

All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

Wire and cable shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.

All field wiring shall be electrically supervised for open circuit and ground fault.

The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

6.0 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). 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, panel modules including initiating circuits, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system controlled devices.

6.1. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

- a. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
- b. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to monitor and control modules.
- c. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade 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.
- d. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
 1. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system alarm LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated

system outputs (alarm notification appliances and/or relays) shall be activated.

2. When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system trouble LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.

3. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system trouble LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

4. When a security alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system security LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

5. When a pre-alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 - a. The system pre-alarm LED shall flash.
 - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
 - c. The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
 - e. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

7.0 Operator Control

1. Acknowledge Switch:

- a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
- b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

8.0 Signal Silence Switch:

Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

1. Drill Switch:

Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

2. System Reset Switch:

Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall re-report if active. Active notification appliance circuits shall not silence upon Reset. Systems that de-activate and subsequently re-activate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re-report upon reset.

3. Lamp Test:

The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

4. Scroll Display Keys:

There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.

5. Print Screen:

Depression of the PRINT SCREEN switch shall send the information currently displayed on the 640-character display to the printer.

9.0 System Capacity and General Operation

1. The control panel shall be capable of expansion via up to 10 SLC modules. Each module shall support a maximum of 318 analog/addressable devices for a maximum system capacity of 3180 points. The system shall be capable of 3072 annunciation points per system regardless of the number of addressable devices.
2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.
3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

10.0 The FACP shall be able to provide the following software and hardware features:

- 10.1 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.
- 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 meet the 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.
- j. History Events: The panel shall maintain a history file of the last 4000 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 4000 event history file.
- k. Smoke Control Modes: The system shall provide means to perform FSCS mode 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. Drill: The system shall support means to activate all silenceable fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function

- n. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which will be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
- o. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
- p. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
- r. 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.
- s. 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.
- t. Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, prealarms, disabled points and activated points, all installed points filtered by SLC points, panel circuits, logic zones, annunciators, releasing zones, spal zones, and trouble zones.
- u. 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.
- v. Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type

Code activates. If silenced alarms exist, a Security alarm will resound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will resound the panel sounder.

- w. 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.
- x. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen. Graphic shall display when all systems are normal.
- y. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.
- z. Tracking/Latching Duct : The system shall support both tracking and latching duct detectors.
- aa. 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.
- bb. NON-FIRE Alarm Module Reporting: A point with a type 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.
- cc. Security Monitor Points: The system shall provide means to monitor any point as a type security.
- dd. 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 CBE

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 pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

- ee. 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.
- ff. 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.
- gg. 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.
- hh. 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.
- ii. 10 trouble equations per device: The system shall provide support for up to 10 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.
- jj. 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.
- kk. Multiple agent 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 with four abort options to satisfy any local jurisdiction requirements.
- ll. 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 or indicating panel module input. 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. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

10.2 Central Processing Unit

- 10.2.1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
- 10.2.2. 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.
- 10.2.3. 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.
- 10.2.4 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.
- 10.2.5 Consistent with UL864 standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.
- 10.2.6 Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
- 10.2.7 The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
- 10.2.8 The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.

- 10.2.9 The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.
- 10.2.10 The CPU shall provide one high-speed serial connection for support of network communication modules.
- 10.2.11 The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.

10.3 Display

- 10.3.1 The system display shall provide all the controls and indicators used by the system operator and will also be used to program all system operational parameters.
- 10.3.2 The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
- 10.3.3 The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten 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, and CPU FAILURE.
- 10.3.4 The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. 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.
- 10.3.5 The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on the 640-character LCD.

10.4 Loop (Signaling Line Circuit) Control Module:

- 10.4.1 The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Photoelectric, Thermal etc.) and 159 monitor or control modules.
- 10.4.2 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.

10.4.3 The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class B) circuit.

10.4.4 The SLC interface board shall be able to drive an NFPA Style 6 twisted shielded circuit up to 12,500 feet in length. The SLC Interface shall also be capable of driving an NFPA Style 6, no twist, no shield circuit up to 3,000 feet in length. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.

10.4.5 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 particular 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 will also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

10.5 Enclosures:

10.5.1 The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

10.5.2 The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.

10.5.3 The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door will be site configured for either right or left hand hinging.

10.5.4 The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

10.6 Power Supply:

10.6.1 The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.

10.6.2 The Addressable Main Power Supply shall provide sufficient 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.

10.6.3 The Addressable 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 25-200 amp-hours within a 48-hour period.

10.6.4 The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.

10.6.5 The Addressable Main Power Supply shall be power-limited per 1995 UL864 requirements.

10.7 Universal Digital Alarm Communicator Transmitter (UDACT).

The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

10.7.1 The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

10.7.2 The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.

10.7.3 The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.

10.7.4 The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.

10.7.5 Communication shall include vital system status such as:

- Independent Zone (Alarm, trouble, non-alarm, supervisory)
- Independent Addressable Device Status
- AC (Mains) Power Loss
- Low Battery and Earth Fault
- System Off Normal
- 12 and 24 Hour Test Signal
- Abnormal Test Signal (per UL requirements)
- EIA-485 Communications Failure
- Phone Line Failure

10.7.6 The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

11.0 Stand Alone Voice Evacuation Control Panel

11.1 A stand alone Voice Evacuation Control Panel shall be available from the same manufacturer of the main fire alarm system.

11.2 This Voice Control Panel shall work stand alone or as a slave to the Main Control Panel.

11.3 Shall have as minimum requirements:

- a. Integral 25 Watt, 25 Vrms audio amplifier.
- b. Speaker circuit that can be wired both Class A or B.
- c. Integral Digital Message Generator with a capacity of up to 60 seconds. The Digital Message Generator shall be capable of primary and secondary messages (30 seconds each). These messages shall field programmable without the use of additional equipment.
- d. Built in alert tone generators with steady, slow woop, high/low and chime tone field programmable.
- e. Integral Diagnostic LEDs for Power, System Trouble, Message Generator Trouble, Tone Generator Trouble, and Alarm.

The Voice Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generators.

Speaker outputs shall be fully power-limited.

12.0 Auxiliary Field Power Supply - Addressable

12.1 The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.

12.2 The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.

12.3 The addressable power supply shall provide four individually addressable Notification Appliance Circuits that will be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.

- 12.4 The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
- 12.5 The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
- 12.6 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.
- 12.7 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.
- 12.8 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 eight or sixteen hours shall be Dip-switch selected.
- 12.9 The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
- 12.10 The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
- 12.11 Each of the power supply's four output circuits shall be DIP-switch selected 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.
- 12.12 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 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
- 12.13 When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
- 12.14 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.

12.15 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.

12.16 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.

13.0 Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or to power Notification Appliances and provide synchronization signals to visual strobe devices.

13.1 The FCPS shall be available in two models offering either up to 6.0 amps (4.0 amps continuous) or 8.0 amps (6.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60-hour standby.

13.2 The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.

13.3 The FCPS shall include an attractive surface mount backbox.

13.4 The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.

13.5 The FCPS include power limited circuitry, per 1995 UL standards.

14.0 System Circuit Supervision:

14.1 The FACP shall supervise all circuits to intelligent devices, annunciators and conventional peripherals and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate that device or devices are not responding and print the information in the history buffer and on a printer.

14.2 Sprinkler system valves, standpipe control valves, PIV and main gate valves shall be supervised for off-normal position.

15.0 Field Wiring Terminal Blocks:

All wiring terminal blocks shall be the plug-in/removable type and shall be capable of terminating up to 12 AWG wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

15.1 Printer

- 15.1.1 Printers shall be of the automatic type, printing code, time, date, location, category, and condition.
- 15.1.2 The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table and UL, ULC listed for use with the NFS-3030. The printer shall communicate with the control using an interface complying with Electrical Industries Association standard EIA-232D. The printer power shall be 120 VAC @ 60 Hz.
- 15.1.3 Thermal printers are not acceptable.
- 15.1.4 The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back up if AC mains are lost. The strip printer shall be UL 864 listed.

16.0 Transponders (Remotely Located Control Panels): (Repeater Panel)

- 16.1 Transponders shall be listed under UL category UOJZ as an independent, local fire alarm control unit as well as being listed as a critical component in a multiplex fire alarm system. Transponders shall be located where shown on the plans.

The transponder shall serve as the interface between conventional initiating fire devices, controlled signaling devices, and the FACP. The supervised multiplex communication port shall be an integral part of the transponder.

- 16.2 Each Transponder shall be powered from a local Power Supply, and shall provide all power necessary for its own operation, including standby power.
- 16.3 Transponders shall be used to house batteries and power supplies to allow a true distributed processing and amplification.
- 16.4 Each transponder shall have the following indicators and operator Controls:
- a. Alarm Acknowledge/Signal Silence/Reset Switch
 - b. Power LED
 - c. System alarm LED
 - d. System trouble LED
 - e. Local piezoelectric signal
 - f. Red alarm per Initiating Device Circuit
 - g. Green on/off LED per notification appliance circuit or relay

- 16.5 Each transponder will be capable of expansion of up to 24 field circuits of the following types in any mix:
- 16.6 a. Initiating Device Circuits (IDC): IDCs will be added to the transponder in groups of 8 Style B (Class B), or 4 Style D (Class A) circuits. Each circuit shall be capable of monitoring up to 30 compatible 2-wire smoke detectors, and/or any number of contact type initiating devices.
- b. Auxiliary Control Relay Outputs: Auxiliary relay outputs will be added to the transponder in groups of eight individually controlled single Form-C circuits. Alternately, the eight independent relays will be configured as four dual Form-C. All relay contacts shall be rated 2 A @ 30 VDC.
- c. Notification Appliance Circuits: Notification Appliance Circuit outputs will be added to the transponder in groups of 8 Class B (Style Y), or 4 Class A (Style Z) circuits. Each circuit shall be capable of being configured as a Telephone, Horn, Strobe or Speaker Circuit.

17.0 Remote Transmissions:

- 17.1 Provide local energy or polarity reversal or trip circuits as required.
- 17.2 The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
- 17.3 Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
- 17.4 Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
- 17.5 System Expansion: Design the main FACP and transponders so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.

18.0 Field Programming

- 18.1 The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
- 18.2 It shall be possible to program through the standard FACP keyboard all system functions.
- 18.3 All field defined programs shall be stored in non-volatile memory.

18.4 Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

18.5 The system programming shall be "backed" up on a 3.5" floppy diskette utilizing an upload/download program. This system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.

The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

It shall be the responsibility of the equipment supplier /installer to ensure that all equipment supplied will fit in locations designated on plans and in the specifications.

19.0 Specific System Operations

19.1 Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.

19.2 Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system will be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system or anytime after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters will be displayed and reset by the proper operator commands.

- 19.3 System Point Operations:
- a. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
 - b. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
- 19.4 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:
- a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Analog Detector Sensitivity.
 - g. All Program Parameters.
- 19.5 System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system statuses:
- 19.6 System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 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 will be manually reviewed, one event at a time, and the actual number of activations will also be displayed and or printed.
- The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
- 19.7 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.
- 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 particular 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.
- 19.8 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.

20.0 Network Control Annunciator

A network control annunciator shall be provided to display all system intelligent points. The NCA shall be capable of displaying all information for all 200,000 possible points on the network. Network display devices, which are only capable of displaying a subset of network points, shall not be suitable substitutes.

The NCA shall include a minimum of 640 characters, backlit by a long life, solid state LCD display. It shall also include a full QWERTY style keypad with tactile feel. Additionally, the network display shall include ten soft-keys for screen navigation and the ability to scroll events by type. i.e. Fire Alarm, Supervisory Alarm, Trouble, etc.

The network control annunciator shall have the ability to display up to eight events in order of priority and time of occurrence. Counters shall be provided to indicate the total number of events by type.

The NCA shall mount in any of the network node fire alarm control panels. Optionally, the network display will mount in a backbox designed for this use. The network shall support a minimum of 103 network control annunciators (not to exceed total node capacity) and shall connect to the network over either a wire or fiber interface.

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 events in non-volatile memory. Systems that do not protect fire alarm events from being overwritten by other events are not suitable substitutes.

The NCA shall include two optically isolated, 9600 baud, industry standard EIA-232 ports for UL864 listed printers and CRT's. These peripheral devices shall print or display network activity.

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.

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.

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 will have different levels of authorization assigned by the Master password.

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.

The network control annunciator shall support an optional Windows™ based program utility. This utility shall allow the user 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.

For time keeping purposes the NCA shall include a time of day clock.

Each NCA shall support up to 32 additional 80 character remote display annunciators for displaying network activity. These "Terminal Mode" displays will mimic the activity appearing on the corresponding NCA.

21.0 Digital Voice Command Center

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, telephone circuit indication and control, digital voice units, microphone and main telephone handset.

Function: The Voice Command Center equipment shall perform the following functions:

Operate as a supervised multi-channel emergency voice communication system.

Operate as a two-way emergency telephone system control center.

Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.

Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.

Provide all-call Emergency Paging activities through activation of a single control switch.

As required, provide vectored paging control to specific audio zones via dedicated control switches.

Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which will be edited and saved on a PC running a current Windows® operating system.

Provide a software utility capable of off-line programming for the VCC 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 VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.

Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SCL controlled switching.

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.

The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

22.0 Audio Amplifiers

22.1 The Audio Amplifiers will provide Audio Power (@70 Volts RMS) for distribution to speaker circuits.

Multiple audio amplifiers will be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).

The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

- Earth Fault on DAP A (Digital Audio Port A)
- Earth Fault on DAP B (Digital Audio Port B)
- Audio Amplifier Failure Detected
- Trouble
- Active Alarm Bus input
- Audio Detected on Aux Input A
- Audio Detected on Aux Input B
- Audio Detected on FireFighter's Telephone Riser
- Receiving Audio from digital audio riser
- Short circuit on speaker circuit 1
- Short circuit on speaker circuit 2
- Short circuit on speaker circuit 3
- Short circuit on speaker circuit 4
- Data Transmitted on DAP A
- Data Received on DAP A
- Data Transmitted on DAP B
- Data Received on DAP B
- Board failure
- Active fiberoptic media connection on port A (fiberoptic media applications)
- Active fiberoptic media connection on port B (fiberoptic media applications)
- Power supply Earth Fault
- Power supply 5V present

Power supply conditions – Brownout, High Battery, Low Battery, Charger Trouble

The audio amplifier shall provide the following built-in controls:

Amplifier Address Selection Switches

Signal Silence of communication loss annunciation

Reset

Level adjustment for background music

Enable/Disable for Earth Fault detection on DAP A

Enable/Disable for Earth Fault detection on DAP A

Switch for 2-wire/4-wire FFT riser

Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.

Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).

System shall be capable of backing up digital amplifiers.

23.0 Audio Message Generator (Prerecorded Voice)/Speaker Control:

Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.

Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.

A built-in microphone shall be provided to allow paging through speaker circuits.

24.0 Speakers:

All speakers shall operate on 70 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.

Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).

Frequency response shall be a minimum of 400 HZ to 4000 HZ.

The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

25.0 System paging from emergency telephone circuits shall be supported.

The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

LED Indicators:
Lamp Test
Trouble
Off-Line Trouble
Microphone Trouble
Phone Trouble
Busy/Wait
Page Inhibited
Pre/Post Announcement Tone

Controls with associated LED Indicators:
Speaker Switches/Indicators

The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.

The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

26.0 Fire Fighters Telephone System

The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.

The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

27.0 Water flow Operation

An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

27.1 Supervisory Operation

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

27.2 Signal Silence Operation

The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

28.0 Sprinkler and Standpipe Valve Supervisory Switches:

Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.

The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.

The switch housing shall be finished in red baked enamel.

The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

29.0 Non-Alarm Input Operation

Any addressable initiating device in the system will be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

Combo Zone

A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

30.0 SYSTEM COMPONENTS:

30.1 Printer

The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.

The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

30.2 Video Display Terminal

The Video Display Terminal shall provide a visual display and an audible alert of all changes in status of the system and shall annotate such displays with the current time-of-day and date.

The Video Display Terminal shall be enclosed in a cabinet suitable for placement on a desktop or table.

A detachable keyboard shall be provided that will be used for programming, testing, and control of the system. Individual keys shall be provided on the keyboard for the ACKNOWLEDGE, RESET, LAMP TEST, SYSTEM TEST, and SIGNAL SILENCE functions of the control panel.

The video display terminal shall include a count of all alarms and troubles in the system, as well as a count of all alarms and trouble requiring acknowledgment. These counts shall be continuously displayed during all FACP operations.

31.0 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

Addressable Devices - General

Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.

Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute.

Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.

Addressable smoke and thermal detectors shall provide dual alarm and power/polling 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.

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.

Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that will affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases 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 detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test will be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device .

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.

Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.

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.

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.

32.0 Programmable Electronic Exit Point Directional Sounders:

Electronic sounders shall operate on 24 VDC nominal.

Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.

Shall be flush or surface mounted as shown on plans.

Shall produce broad band directional sound to guide occupants to safe exists even in complete darkness.

Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

The maximum pulse duration shall be 2/10 of one second.

Strobe intensity shall meet the requirements of UL 1971.

The flash rate shall meet the requirements of UL 1971.

Field Wiring Terminal Blocks

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.

33.0 Addressable Manual Fire Alarm Box (manual station)

Addressable manual fire alarm boxes shall, on command from the control panel, 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.

All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

34.0 Intelligent Multi-Co-Operative Sensing type Photoelectric Smoke Detector

The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall be in position to work in advance multi Co-Operative Sensing, on command from the control panel, send data to the panel representing the analog level of smoke density.

35.0 Intelligent Thermal Detectors

Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

36.0 Intelligent Laser Photo Smoke Detector

36.1 The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser 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.

- 36.2. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
- 36.3. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.03 percent per foot.
- 36.4. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
- 36.5. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
- 36.6. The laser 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.
- 36.7. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

37.0 Intelligent Multi Criteria Acclimating Detector

- 37.1 The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
- 37.2 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).
- 37.3 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.

38.0 Intelligent Duct Smoke Detector

- 38.1 The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
- 38.2 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.

39.0 Hostile-Area Smoke Detector

- 39.1 The detector shall be designed to provide early warning smoke detection in environments where traditional smoke detectors are not practical.
- 39.2 The detector shall have a filter system to remove particles down to 25 microns.
- 39.3 This filter system shall remove unwanted airborne particles and water mist. This shall allow the detector to operate in environments where traditional smoke detectors would have nuisance alarms.
- 39.4 The filter system shall consist of 2 filters one of which is field replaceable.
- 39.5 The filter system shall have an intake fan to draw air and smoke through the filters into the sensing chamber.
- 39.6 The filter system shall be supervised so that if the filter is clogged or the fan fails the control panel reports trouble.
- 39.7 The filter system shall be powered from 24 VDC separate from the SLC communications.
- 39.8 The detector shall utilize a photoelectric sensing chamber.

40.0 Two Wire Detector Monitor Module

- 40.1 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).
- 40.2 The IDC zone will be wired for Class A or B (Style D or Style 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.

41.0 Addressable Control Module

- 41.1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.

- 41.2. The control module NAC will be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
- 41.3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
- 41.4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

42.0 Addressable Relay Module

- 42.1 Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs will be energized at the same time on the same pair of wires.

43.0 Isolator Module

- 43.1 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 will 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.
- 43.2 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.
- 43.3 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.
- 43.4 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.

44.0 BATTERIES:

The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes 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 will be used.

45.0 EXECUTION

45.1 INSTALLATION:

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.

All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and will 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.

All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and will be surface mounted when located in unfinished areas.

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.

45.2 TEST:

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 of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

Verify activation of all water flow switches.

Open initiating device circuits and verify that the trouble signal actuates.

Open and short signaling line circuits and verify that the trouble signal actuates.

Open and short notification appliance circuits and verify that trouble signal actuates.

Ground all circuits and verify response of trouble signals.

Check presence and audibility of tone at all alarm notification devices.

Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

Each of the alarm conditions that the system is required to detect should 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.

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.

45.3 FINAL INSPECTION:

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.

46.0 INSTRUCTION:

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.

The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

APPENDIX-E**LIST OF RELEVANT INDIAN STANDARDS**

S.NO	I.S. NO.	Title
1.	IS-8757	Glossary of terms associated with fire safety
2.	IS-884	Specification for first-aid hose reel for fire fighting
3.	IS-901	Specification for couplings, double male and double female instantaneous pattern for fire fighting.
4.	IS-902	Specification for suction hose couplings for fire fighting purposes.
5.	IS-903	Specification for fire hose delivery coupling, branch pipe, nozzles and nozzles spanner.
6.	IS-904	Specification for two-way and three- way suction collecting heads for fire fighting purpose.
7.	IS-907	Specification for suction strainers, cylindrical type for fire fighting purposes.
8.	IS-908	Specification for fire hydrant, stand post type.
9.	IS-909	Specification for under ground fire hydrant.
10.	IS-636	Non percolating flexible fire fighting delivery hose.
11.	IS-7637	Glossary of terms for fire fighting equipment.
12.	IS-937	Specification for washers for water fittings for fire fighting purposes.
13.	IS-1641	Code of practice for fire safety of buildings (general): General principal for fire grading and classification.
14.	IS-1642	Code of practice for fire safety of buildings(general :Details of construction.
15.	IS-1643	Code of practice for fire safety of buildings (general): Exposure hazard.
16.	IS-1644	Code of Practice for fire safety of buildings (general): Exit requirements and personal hazard.
17.	IS-1646	Code of practice for fire safety of buildings (general): Electrical installations.
18.	IS-2871	Specifications for branch pipe, universal for fire fighting purposes.
19.	IS-2930	Functional requirements for hose laying tender for fire brigade use.
20.	IS-5290	Specification for landing valves.
21.	IS-8090	Specification for couplings, branch pipe, nozzle, used in hose reel tubing for fire fighting.
22.	IS-8442	Specification for stand post type water monitor for fire fighting
23.	IS-9972	Specification for automatic sprinkler heads.
24.	IS-11101	Specification for extended branch pipe for fire brigade use.
25.	IS-12349	Fire protection-safety sign.

26.	IS-12407	Graphic symbols for fire protection plan.
27.	IS-9668	Code of practice for provision and maintenance of water supplies and fire fighting
28.	IS-3844	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.
29.	IS-12585	Specification for thermoplastic house (Textile Reinforced)
30.	IS-10221	Code of practice for coating and wrapping of under ground mild steel pipe lines.
31.	IS-15105	Design and installation of fixed automatic sprinkler fire extinguisher system-code of practice.
32.	IS-325	Three phase induction motors.
33.	IS-1822	Motor starter for voltage not exceeding 1000 volts.
34.	IS-3624	Burden tube pressure and vacuum gauges.
35.	IS-1520	Horizontal centrifugal pumps for clear, cold, fresh water.
36.	IS-1239	Mild steel tubes, tubular and other wrought steel fittings.
37.	IS-3589	Electrically welded steel pipes for water, gas and sewage.
38.	IS-6392	Steel pipe flanges.
39.	IS-778	Gun metal gate, globe and check valves for general purpose.
40.	IS-2592	Recommendation for methods of measurement or fluid flow by means of orifice plates and nozzles.
41.	IS-732	Code practice for electrical wiring and fittings of building.
42.	IS-900	Code of practice for installation and maintenance of induction motor.
43.	IS-1248	Direct acting electrical indicating instruments.
44.	IS-2516	A.C. circuit breakers for voltage not exceeding 1000 volts.
45.	IS-4047	Heavy duty air break switches and composite units of air break switches and fuses for voltage not exceeding 1000 volts.
46.	IS-2208	HRC cartridge fuse links upto 650 volts.
47.	IS-1554	PVC insulated (heavy duty)
48.	IS-1536	Centrifugally Cast iron pipe
49.	IS-1537	Vertically cast iron pipe
50.	IS-1538	Cast iron pipe fitting
51.	IS-780	Sluice valve for water works purposes(50 to 300 mm.size)
52.	IS-13095	Butterfly valves.

CHAPTER-13

Make of Materials for Fire Fighting Works & Fire detection and Alarm system or as approved by consultant

SI No	Item / Material	Make
1	MS Pipes as per IS:1239/3589	Jindal /Surya Prakash/Tata
2	Pipes Fittings	Jainsons/ VS
3	Gunmetal Ball Valves	Zoloto / Kartar / Sant
4	Dual/ Disk Type NRV/ Slim Seal Butterfly Valves	C & R / Advance/Sant/AIP
5	CI Sluice Valve	Kartar/ Sant/ Sant/AIP
6	Fire Hydrant Valves	Safeguard / Exflame/Padmini
7	Fire Hose Pipes/ CP Hose/ RRL Hose	Safeguard / Exflame/Padmini
8	First Aid Fire Hose Reels (With Drum & Brackets)	Safeguard / Exflame/Padmini
9	Cables	Gloster / Sky tone
10	Pipe Coat Material (Pipe Protection)	Pypkote / IWL
11	Main Control Panel (Powder Coated)	A K Controls/ Elegant Controls
12	Fire Brigade Inlet, Fire Man's Axe	Safeguard / Exflame/Padmini
13	Rubber Hose Pipes	Jyoti / Tiger/ Padmini
14	Hose Couplings Branch Pipe & Nozzle	Safeguard / Exflame/Padmini
15	Fire Extinguishers	Safeguard / Exflame/Padmini
16	MS Conduit	BEC / AKG
17	Paint Primers	Asian / Berger
18	Weld. Electrodes	Victor / Esab
19	Pumps	Kirloskar / Crompton Greaves
20	PVC Copper Wire	Sky Tone / Finolex
21	Pressure Gauge	H Guru / Fiebing
22	Pressure Switch	Danfoss / Indfoss
23	Photo Electric smoke detectors with indication	EST Edward / System Sensor
24	Response Indicator Lamp assembly	Agni Protection / PCD
25	'FIRE EXIT' Signage	Agni Protection / System tek
26	Manual call boxes	EST Edward / Agni Protection
27	Speaker-cum-hooter	EST Edward / Ahuja
28	Repeater panel	EST Edward / Daksh Electronics
29	Fire alarm control panel	EST Edward / Daksh Electronics
30	Control Cables & Wires	Havells / Finolex / National
31	PVC Conduit	Bec/Akg

SECTION IV – SPECIAL CONDITIONS OF THE CONTRACT

4.1.0 Insurance for Works

The contractor at the time of signing the contract or before commencing the execution of work, without limiting his obligations and responsibilities shall insure the works at his own cost and keep them insured until the virtual completion of the contract against all risks and acts of God including Fire, Theft, Riots, War, Floods etc. with a Nationalized Insurance company in the joint names of the employer and the contractor (the name of the former being placed first in the policy) for the full amount of the contract. Such policy shall cover the property of the employer and fees for assessing the claim and in connection with its services generally therein and shall not cover any property of the Contractor or of any sub contractor or employee. Such insurance shall be for a minimum value of Rs. 1.0 lakhs (Rupees One Lakh only).

The contractor shall deposit the policy and receipt for the premiums with the employer within seven (7) days, from the date of signing of the contract/commencement of the execution of the work or unless otherwise instructed by the employer. In default of the contractor insuring as provided above, the employer on his behalf will so insure and will deduct the premiums paid from any moneys due on which will become due to the contractor. The contractor shall as soon any claim under the policy is settled on the work reinstated by the Insurance office should elect to do so, proceed with all due diligence with, the completion of the works in the same manner as through the misfortune/accident had not occurred and in all respects under the same conditions of the contract. The contractor in case of rebuilding or reimbursement after accident shall be entitled to such extension of time for completion, as the employer deems fit.

4.1.1 Insurance in respect of damage to persons and property

- a. The contractor shall be responsible for all injury to persons, animals or things and for all structural and decorative damage to property which will arise from the operation or neglect of himself or of any approved sub-contractor's or employees, whether such injury or damage arise from carelessness, accident or any other cause whatsoever in any way connected with the carrying out of this contract. The clause shall be held to include any damage to buildings, whether immediately adjacent or otherwise, and any damage to roads, streets, foot paths, bridges and works forming the subject of this contract by frost or other inclemency of the weather. The contractor shall indemnify the employer and hold him harmless damage to persons or property as aforesaid and also respect of any claims made in respect of injury or damage under any Acts of Government or otherwise and also in respect of any award of compensation of damages consequent upon such claims.

- b. The contractor shall reinstate all damages of every sort mentioned in this clause, so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of third parties.
- c. The contractor shall indemnify the employer against all claims which will be made against the employer by any member of the public or other third party in respect of works in consequence thereof and shall at his own expense arrange to effect and maintain, until the virtual completion of the contract, with any Nationalised Insurance company in the joint name of the employer and the contractor against such risks and deposit such policy or policies with the employer from time to time during the currency of this contract. The contractor shall similarly indemnify the employer against all claims which will be made upon the employer whether under the Workman's Compensation Act or any other statute in force during the currency of this contract or at common law in respect of any employee of the contractor or any sub-contractor and shall at his own expenses effect and maintain with an approved office a policy of Insurance in the joint names of the employer and the contractor against such risks and deposit such policy or policies with the employer and the contractor against such risks and deposit such policy or policies with the employer from time to time during the currency of the contract. The contractor shall be responsible for any thing which will be excluded from the insurance policies above referred to and also for all other damages to any property arising out of and incidental to the negligent or defective carrying out of this contract. He shall also indemnify the employer in respect of any costs, charges or expenses arising out of any claim or proceedings and also in respect of any award of or compensation of damages arising there from.
- d. The employer shall be at liberty and is empowered to deduct the amount of any damages, compensation costs, charges and expenses arising or occurring from or in respect of any such claim or damage from any sum or sums due to or become due to the contractor including the security deposit.
- e. If the contractor fails to comply with the terms of these conditions, the employer will insure the works and any other item/article associated with or arising from same and any risk arising as a consequence of this contract and will deduct the amount of the premiums paid from any moneys that will be or become payable to the contractor or will at the option, not release running payment to the contractor until the contractor shall have complied with the terms of this condition.
- f. Such insurance whether effected by the employer or the contractor will not limit or bar the liability and obligation of the contractor to deliver the works to

the employer completed in all respects according to the contract. In case of loss or damage due to any of the aforesaid clause, the moneys payable under any such insurance shall be received and retained by the employer until the works are finally completed and such moneys shall then be credited to the contractor in final settlement of accounts after setting off any money payable to the employer or recoverable by the employer.

- g. No incomplete works shall be accepted and nothing shall be paid to the contractor. However the part rates will be allowed to the contractor for the executed works which shall be treated as advance and the same will be recovered if the works left incomplete.

h. USE OF WATER , DRAINAGE AND ELECTRICITY

- i. The main contractor shall be allowed to use adequate available quantity of construction water and electricity "Free of cost" at the work site for all the legitimate works by the employer. The contractor will, however, draw water/electricity from or designated central point with his own pipes, cables and distribution system through valves/switches including providing small water storage tank etc. without causing any spillage and misuse. However, in case of shortage or breakdown of electricity or water supply the contractor shall make alternative arrangements at his own expense so as to ensure timely progress and completion of works.

The contractor shall ensure uninterrupted supply of water, electricity, access to staff and disposal of sewage/waste to be maintained for existing occupants/within the building premises. The employer does not guarantee adequacy or continuity of electricity and water supply.

- ii **AGENCY FOR ELECTRICAL INSTALLATIONS** All works under Electrical services of Bill Of Quantities shall be carried out by licensed contracting agencies.

All necessary approvals, formalities of the local and other authorities, department's etc. shall be complied with by the Main Contractor

I COLOUR SCHEME FOR THE EQUIPMENT AND COMPONENTS.

- i The entire metal work above ground level shall be painted with red colour shade No. 532 of IS: 5.
- ii Pump, motor and engine shall be painted with red colour shade No. 536 of IS: 5.