



सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
केन्द्रीय लोक निर्माण विभाग
CENTRAL PUBLIC WORKS DEPARTMENT

वैद्युत कार्यों के लिए सामान्य विनिर्देश
GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS



भाग-VI अग्नि संसूचन एवं सचेतक प्रणाली
2018

PART-VI FIRE DETECTION AND ALARM SYSTEM
2018



महानिदेशालय, के.लो.नि.वि., निर्माण भवन, नई दिल्ली-110011
DIRECTORATE GENERAL, CPWD, NIRMAN BHAWAN, NEW DELHI-110011



सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
केन्द्रीय लोक निर्माण विभाग
CENTRAL PUBLIC WORKS DEPARTMENT

वैद्युत कार्यों के लिए सामान्य विनिर्देश
GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS



भाग-VI अग्नि संसूचन एवं सचेतक प्रणाली
2018

PART-VI FIRE DETECTION AND ALARM SYSTEM
2018



महानिदेशालय, के.लो.नि.वि., निर्माण भवन, नई दिल्ली-110011
DIRECTORATE GENERAL, CPWD, NIRMAN BHAWAN, NEW DELHI-110011

All rights reserved. No part of this publication may be reproduced in any form or by any means, electronic or mechanical, including photocopy, recording or any information storage and retrieval system, without permission, in writing from the Director General, CPWD, New Delhi.

GOVERNMENT OF INDIA PUBLICATION

Published under the authority of

Directorate General
Central Public Works Department
Nirman Bhawan, New Delhi-110011



PRABHAKAR SINGH
Director General



सत्यमेव जयते

भारत सरकार
Government of India



केन्द्रीय लोक निर्माण विभाग
निर्माण भवन, नई दिल्ली-110011
Central Public Works Department
Nirman Bhawan, New Delhi-110011
Tel : 23062556/1317, Fax : 23061884
E-mail : cpwd_dgw@nic.in

FOREWORD

CPWD is responsible for the design, construction and maintenance of a large number of buildings of the Government of India. Fire Detection and Alarm Systems is required for annunciation to occupants in view of the ensuing vulnerability and to warn occupants early of existence of fire, so as to facilitate orderly and safe egress.

These revised General Specifications for Electrical Works Part – VI (Fire Detection and Alarm System) 2018 serve the need for the design, construction and maintenance of buildings. The first Fire alarm system specifications “General Specifications for Electrical Works Part- VI Fire Alarm System” was published by CPWD in 1988. Since then there have been tremendous changes in the field and technologies have progressed rapidly.

To incorporate the latest developments and technologies in the field and to include “Intelligent Addressable Fire Detection and Alarm System”, the existing specifications have been revised and enlarged which covers the provisions for Intelligent Addressable Fire Detection and Alarm System in addition to the conventional Fire Detection and Alarm System. The need has also been felt to modify the specifications to bring the specifications on a par with modern technical developments and also to incorporate the revisions made in the National Building Code of India and The Indian Standards over the time period.

I Acknowledge the hard work and effort put in by the officers of the group constituted for revision of specifications consisting of Shri Vikas Gupta, CE (PEWZ), Shri Vimal Kumar, CE (NDZ-II), Shri N.K. Bansal, SE (DCEC-6), Shri Ramesh Kumar Garg, SE (PEWC), Shri S.S. Garg, SE (E) Vigilance Cell, Shri Gaurav Yadav, EE (PHED) under the guidance of Shri A.S. Arora, ADG (TD) and Shri C.K. Varma, CE CSQ (E). My special thanks to Shri J.K. Chowdhary, retired Chief Engineer (E), CPWD, who extended his help in revision of the specifications. I also acknowledge the valuable suggestions of the other members of Specification Committee as well as all those involved in the process of revision and finalization of Specifications.

I am sure that these Specifications will be useful to all concerned Engineers of CPWD and also to many other Engineering organizations of Central/ State Governments as well as practicing Architects and E&M Consultants.

Place: New Delhi

Date: July 2018

(Prabhakar Singh)
Director General, CPWD



सत्यमेव जयते

अवतार सिंह अरोड़ा
AVTAR SINGH ARORA

भारत सरकार
Government of India
अपर महानिदेशक (प्रौ.वि.)
Additional Director General (TD)
केन्द्रीय लोक निर्माण विभाग
Central Public Works Department

प्रथम तल, कमरा संख्या 118 ए-विंग निर्माण भवन, नई दिल्ली-110 011

First Floor, Room No. 118, A Wing, Nirman Bhawan
New Delhi-110 011, Phone : 23063389, fax : 23061608
E-Mail : adgtd@nic.in



P R E F A C E

The CPWD General Specifications for Electrical Works Part – VI (Fire Detection and Alarm System) 2018 is the revised and enlarged edition of CPWD “General Specifications for Electrical Works Part- VI Fire Alarm System 1988”. There was a growing need to revise these Specifications due to major technological changes such as introduction of Intelligent Addressable equipments etc. in the field of Fire Detection and Alarm System over a period of time and to incorporate the modifications in National Building Code of India as well as in Indian Standards. This edition incorporates the relevant provisions of National Building Code of India 2016 and latest Indian Standards.

The CPWD General Specifications for Electrical Works Part – VI (Fire Detection and Alarm System) 2018 consists of mainly two parts, Part A - Conventional Type Fire Detection and Alarm System and Part B – Intelligent Addressable Type Fire Detection and Alarm System. This edition also consists maintenance of Fire Detection and Alarm System and list of referred Indian Standards. The CPWD General Specifications for Electrical Works Part – VI (Fire Detection and Alarm System) 2018 now replaces the CPWD “General Specifications for Electrical Works Part- VI Fire Alarm System 1988”.

I am grateful to Shri Prabhakar Singh, Director General, CPWD for reposing trust in me to undertake this arduous task in a shortest period of 3 months. My acknowledgements are due to the officers of the group constituted for revision of Specifications. I acknowledge the efforts put in by the members of the Specifications Committee for thorough discussion and making useful amends wherever due to make this revision a useful exercises. I acknowledge the efforts of Shri C.K. Varma, CE CSQ (E), who has contributed in providing technical contributions and administrative support to make the entire exercises of the revision possible within given time frame.

I also acknowledge for the valuable inputs and useful contribution in this task by Shri D.K. Tulani, SE (E) TAS and Shri P.K. Srivastava, EE(E)TAS. Errors, omissions and/or suggestions for improvements, if any, may be brought to the notice of Superintending Engineer (E) TAS, in the office of Chief Engineer CSQ (E), CPWD, Nirman Bhawan, New Delhi-110011 (011-23061418).

Place: New Delhi

Date: July 2018

(Avtar Singh Arora)

Addl. Director General (TD), CPWD

MEMBERS OF SPECIFICATION COMMITTEE FOR E&M WORKS

1.	Sh.Prabhakar Singh, DG, CPWD	Chairman
2.	Sh. A.S. Arora, ADG (TD),CPWD	Member
3.	Sh. S.K. Chawla, ADG (ER), CPWD	Spl. Invitee
4.	Sh. K. V. Singh, ADG (Trg.), CPWD	Member
5.	JS & CVO or his representative (Sh. S. S. Garg)	Member
6.	Sh. Satish Chandra Bhardwaj, CE(NDZ-V)	Member
7.	Sh. C.K.Varma,CE (E) CSQ, CPWD	Member
8.	Sh. A. K. Ahuja, CE (E), PWD	Member
9.	Sh. Sandeep Mehta, CE (E) DDA	Spl. Invitee
10.	Chief Technical Examiner or his representative	Member
11.	Sh. Shahabuddin Ahmad, CE (E), BFLZ	Member
12.	Sh. Ujjwal Mitra, CE (NDZ)-III	Member
13.	Sh. Harish Kumar, DDG (W), CPWD	Member
14.	Sh. Rajesh Jain, CE (E)Trg, National CPWD Academy	Member
15.	Sh. Vikas Gupta, CE (E)PEWZ	Member
16.	Sh. Vimal Kumar, CE (NDZ-II)	Member
17.	Sh. Vikas Rana, CE (NDZ-VII)	Member
18.	Sh. Saurabh Chopra, DDG (Coord.) NR	Member
19.	Sh. J. K Choudhary, CE (E), Retd.	Spl. Invitee
20.	Sh. C.S.Mittal, Retd. CPM (PNB PZ)	Spl. Invitee
21.	Ms. Sonia Mehta, CA(NDR), CPWD	Member
22.	Sh. G. C. Kabi, CE CSQ (C), CPWD	Member
23.	Sh. Ashish Singh, Director Finance	Member
24.	Sh. Ramesh Kumar Garg, SE (E) PEWC, CPWD	Spl. Invitee
25.	Sh. Ujjawal Kumar, SE(E)DCEC-IX	Spl. Invitee
26.	Sh. Awadhesh Kumar, SE(E)DCEC-I	Spl. Invitee
27.	Sh. Ram Janm Ram, EE(E)P, DCEC-VII	Spl. Invitee
28.	Sh. B. S. Bharti, EE(E)P, DCEC-VI	Spl. Invitee
29.	Sh. D.K. Tulani, SE (E) TAS, CPWD	Member Secretary

REFERENCE TO AMENDMENTS

S.No.	Reference under which issued	Para No.	Page No.	Remarks

CONTENTS

Section No.	Description of Item	Page No.
PART - A		
	Fire Detection and Alarm System (Conventional)	1
1	Introduction & General	3
2	Manual Call Boxes	12
3	Automatic Fire Detectors	14
4	Control & Indicating Panels & P.A. System	19
5	Sounders & Silencing Switches	25
6	Mimic Diagram	28
7	Power Supply Equipment & Wiring	29
PART - B		
	Intelligent Addressable Fire Alarm System	31
1	Introduction	33
2	Manual Call Points	35
3	Intelligent Addressable Fire Detectors	36
4	Addressable Fire Alarm Control Panel	41
5	Addressable Intelligent Sounders & Silencing Switches	48
6	Mimic Panel	50
7	Power Supply Equipment & Wiring	51
	Intelligent Fire Alarm System (Loop System) – Diagram	53
	Specimen Draft NIT	55
	(i) Press Notification	55
	(ii) Commercial and Additional Conditions	55

CONTENTS

Section No.	Description of Item	Page No.
Appendix-I	Schedule 'A' Schedule of Technical Particulars	63
	Schedule 'B' Addresses of Manufacturers	65
	Schedule 'C' Schedule of Programme of Work	66
	Schedule 'D' Schedule of Departure from Specifications	67
Appendix-II	Terminology	68
Appendix-III	(ABSTRACT OF NBC-2016)	73
Appendix-IV	Installation Guidelines for Detectors (Both for Conventional and Intelligent FAS)	85
Appendix-V	Inspection, testing and commissioning	93
Appendix-VI	Maintenance of the Fire Alarm System	95
Appendix-VII	List of referred Indian Standards	98

PART-A

FIRE DETECTION AND ALARM SYSTEM (CONVENTIONAL)

SECTION – 1

INRODUCTION & GENERAL

1.1 INDTRODUCTION :

Fire safety is very important consideration in building construction and maintenance. Now a days due to constraint of availability of land, construction of high rise buildings is coming up very fast hence fire safety measures have greater importance. Even buildings of lesser heights where fire protection measures are essential by virtue of type of occupancy and contents such as archival records, museums with rare art pieces, super computer, computer installations, libraries, auditoria, telephone exchanges etc. Even in normal office building fire risk is high due to a large quantity of papers, files furniture & curtains etc.

The aim of providing fire safety measures is to provide protection to life of occupants and property in the event of fire. The details of fire safety measures are provided in National Building Code 2016 and in Local Fire bylaws.

It is not sufficient to provide fire safety measures but more important is to take timely action by the personnel responsible for fire safety measures in the buildings. This would include locating the fire, evacuating the occupants quickly in organized manner, calling the fire brigade and in the meantime using the first hand fire fighting appliances to control the fire. Such personnel should have necessary training to perform the above activities. These activities should therefore be coordinated with the client department who is occupant of the building as they have to keep watch & ward & up keep of the premises. The security personnel should also be trained to take action in case of fire.

1.2 **Role of Fire Alarm System:**

Fire Alarm system is required to provide the following functions:

- (i). Protection of life
- (ii). Protection of property.

1.2.1 **Protection of life:**

Fire can kill by asphyxiation, poisoning, irradiation or burning. Smoke density, ambient temperature and/or carbon monoxide concentration beyond certain limits can endanger human life. Over-riding priority is to be given for detection of smoke due to the following factors:

- (i) Main threat to life in fire emergency emanates from smoke and toxic fumes.
- (ii) Smoke and lethal gases travel rapidly to areas far from fire due to strong convection currents.
- (iii) Detectable quantity of smoke from a hostile fire precedes detectable heat level and development of lethal atmosphere.

- (iv) Smoke brings down the visibility and may cause loss of visibility on escape routes. Where the visibility is low, say less than 10 meters, the inmates may feel reluctant to walk through smoke.

In life safety installations, it is therefore essential to:

- (i) Give primary attention to detect fire in the incipient stages and to protect escape routes.
- (ii) Ensure operation of detectors on escape routes before visibility falls below 20 mts.
- (iii) Ensure provision of pressurization system, smoke extraction system, smoke control etc. on escape routes wherever required as per National Building Code 2016.

1.2.2 Protection of Property:

People may not always be present, mobile or alert in all parts of premises, housing property even during normal occupancy hours. Premises may remain unattended or unsupervised for long and short periods. When fire starts in such areas it gets time to grow to a stage where it cannot be easily extinguished. Installation of fire detectors enables early detection and extinction by reducing delay between ignition and start of fire fighting measures. As rapid and extensive loss of property is caused by flaming combustion. Detectors should be efficient in detecting flaming fire to keep losses to a minimum. It is important to minimize incidence of false alarms particularly when detectors are hooked to actuate means of automatic extinguishing. Automatic extinguishing should generally be initiated only on confirmation of two detecting signals to avoid possibility of false actuation:

1. Computer/ Electronic Data Processing (EDP) Centre/Electronic equipment which have a very high value should be protected by smoke detectors.
2. Archives, high value libraries, and museums with high value combustibles should be protected by combination of heat, flame, smoke detectors. The heat detectors should be used on the racks and cupboards and smoke detectors in open space on the ceiling, flame detectors may be used where height of the ceiling is more than 9 meters.
3. Flammable liquid in small quantities stored in confined spaces where ambient temperature is high or where chances of rapid heat built up exist (such as garage, repair shops, store areas. etc.), heat or flame detectors should be provided.

1.3 GENERAL

1.3.1 Scope:

These general specification cover the details of equipment to be supplied, inspected as may be necessary before dispatch, delivery at site, installation, testing, commissioning and handing over in working condition of Fire Alarm System and Automatic Fire Alarm System (called FAS and AFAS).

1.3.2 Related documents:

These technical specifications shall be read in conjunction with the standard conditions of contract with all correction slips as are relevant for commercial aspects, as well as schedules and drawings and requirements under these specifications. In the event of any discrepancy between these specifications and tender specifications the latter shall be followed and deemed to be having over-riding value.

1.3.3 Definition of terms:

The definitions of terms used in these general specifications are given in Appendix-II (Terminology).

1.4 System Engineering:

1.4.1 General

FAS/ AFAS installation comprises of trigger devices, automatic as well as manual indicating panels, sounders, power supply equipments including stand by battery unit, system wiring and mimic diagrams.

1.4.2 Scope of work:

The scope of FAS / AFAS installation work shall generally comprise the supply, installation, testing and commissioning of the following. The scope shall also include the engineering design of the system, using the equipment offered.

- (i) Trigger devices viz. automatic fire detector of the required types and/or manual call boxes.
- (ii) Sounders of low intensity and high intensity types.
- (iii) Control and indicating panels including repeater panels, if any.
- (iv) Standby battery and charging unit.
- (v) Mimic diagram (s)
- (vi) P.A. System.
- (vii) System wiring.

1.5 Conformity to Statutory Acts, Rules, Regulations, Standards & Safety Codes.

1.5.1 Indian Electricity Act and Rules :

All electrical works in connection with installation of FAS and AFAS shall be carried out in accordance with the provision of Indian Electricity Act, 2003 and the Indian. Electricity Rules 1956, both amended upto date.

1.5.2 CPWD Specification :

The electrical installation work shall conform to CPWD General Specifications for electrical works Part I (Internal) 2013 and Part-II (External) 1994, both amended upto date.

1.5.3 Indian Standards:

The system/components shall conform to relevant Indian Standards and National Building Code 2016 amended up to date.

1.5.4 International Standard:

Conformity to International Standards is required only in the case of imported fire detectors. The standards applicable shall be indicated by the tenderer in their offer.

1.5.5 Fire regulations:

The installation shall be carried out in conformity with the local Fire Regulations & Rules there under wherever they are in force and the provisions in local bye-laws, if any.

1.5.6 Safety Codes and Labour Regulations:

In respect of all labour employed directly or indirectly on the work, the successful tenderer (herein after called the contractor) at his own expense will arrange for the safety provisions to comply with the statutory regulations, B.I.S. recommendations and CPWD Codes. In case of default, the department shall be at a liberty to make arrangements and provide facilities as aforesaid and recover the cost from the contractor.

The contractor shall provide necessary barriers, warning signals and other safety measures to avoid any accident. He shall also indemnify CPWD against claims for compensation arising out of negligence in this respect.

Nothing in these specifications shall be construed to relieve the contractor of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with applicable Statutory Regulations and Safety Codes in force from the safety angle.

1.6 Component performance:

All components of FAS /AFAS shall be new and suitable for the environment of installation at site. These shall be satisfactory in operation at voltage deviated by $\pm 10\%$ from the nominal value.

1.7 Information and drawings to be supplied by the Department:

1.7.1 Schedule of work :

The schedule of work along with other relevant information, as per format in Appendix-I, shall be supplied with the tender papers along with the detailing of the equipment and materials required and the estimated quantum of work required to be executed.

1.7.2 Drawings :

All drawings specified and issued with the tender specifications are for the purpose of tendering only.

1.8 Works to be arranged by the Department:

Unless otherwise mentioned in the tender specifications, the following works shall be carried out by the Department.

- (i) Electric Power Supply for testing and operation, single phase 230 V 50 Hz A. C. at the C&I Panel, alongwith main earth lead.
- (ii) Frame-work in false ceiling if the low intensity sounder is to be recessed therein.

1.9 Works to be done by the Contractor:

In addition to supply, installation, testing and commissioning of all the equipments and materials as per the schedule of work, the following works shall be deemed to be included within the scope of work to be executed by the contractor, whether or not indicated in the schedule of work.

- (i) Extension of the conduit ends upto the FAS / AFAS Equipments and loop earthing as required.
- (ii) All minor building work such as cutting and making good the damages.
- (iii) Necessary testing equipments.
- (iv) Watch and ward of the equipments, materials and installation, till their handing over to the department duly installed and commissioned.
- (v) Approval from the concerned fire authorities as may be required as per the local Fire Regulations and byelaws.

1.10 Inspection of site and collection of data:

The tenderer shall be deemed to have examined the tender documents, detailed specifications, data etc. and to have visited the site or ascertained all relevant details for offering suitable equipment and for the installation work.

1.10.1 Inspection and testing

(a) Initial inspection and testing

- (i) Initial inspection of materials & equipments at manufacturer works may be done by the Engineer-in-Charge or his representative. For item/equipment requiring initial inspection at manufacturer works, the contractor will intimate the date of testing of the equipments at the manufacturer's works before dispatch. The contractor shall give sufficient advance notice regarding the dates proposed for such tests to the department representative(s) to facilitate his presence during testing. The Engineer-in-Charge at his discretion may witness such testing. Equipments will be inspected at the manufacturer/authorized dealer's premises, before dispatch to the site by the contractor. The cost of Engineer's visit to the manufacturer/ authorized dealer premises will be borne by the department.

- (ii) The department also reserves the right to inspect the fabrication job at factory and successful tenderer has to make arrangements for the same.
- (iii) The materials shall be dispatched to site of work by the contractor after getting duly inspected by Engineer-in-Charge or his authorized representative.

(b) Final Inspection & Testing

Final inspection & testing will be done by the Engineer-in-Charge or his representative as per details indicated in Appendix-IV & VI under "Installation, testing & commissioning".

The installation will be offered for inspection to local body (Chief Fire Officer), The contractor will extend all help including test facilities to the representative of Chief Fire Officer. In case contractor fails to make desired facilities available during inspection, the department reserves the right to provide the same at the risk & cost of the contractor. The observation of Chief Fire Officer which are a part of agreement shall be promptly attended by the contractor. The installation will be accepted by the department only after receiving clearance from Chief Fire Officer.

(c) Safety Measure:

All equipments shall incorporate suitable safety provisions to ensure safety of the operating personnel at all times. The initial and final inspection reports shall bring out explicitly the safety provisions incorporated in each equipment.

1.11 Terms of payment:

The following percentage of contract rates for the various items included in the contract shall be payable against the stage of work shown herein;

- (i) 80% after initial inspection and delivery at site in good condition on prorata basis.
- (ii) 10% after completion of installation in all respect,
- (iii) Balance 10% will be paid after testing, commissioning, trial run and handing over to the department for beneficial use including fire inspection.

(a) Rates

The rates quoted by the tenderer shall be firm and inclusive of all taxes, duties, levies and all charges for packing, forwarding, insurance, freight, delivery, installation, testing and commissioning etc. at site including temporary construction of storage, risks, over head charges, general liabilities/obligations and clearance from local bodies and State Fire Services, as applicable. However, the fee for these inspections shall be borne by the department.

(b) Storage and Custody of Material

Watch and ward of the stores and their safe custody shall be the responsibility of contractor till the final taking over of the installation by the department.

1.11.1 Information to be supplied by the tenderer:

The following schedules in the proforma given in Appendix-I shall be submitted with the tender:-

- | | | |
|--|---|----------------|
| (i) Schedule of technical particulars | - | Schedule 'A' |
| (ii) Schedule of addresses of manufacturers | - | Schedule 'B' |
| (iii) Schedule of programme of work | - | Schedule - 'C' |
| (iv) Schedule of departure from specifications | - | Schedule - 'D' |

The tenderer shall furnish data and technical particulars, printed pamphlets, etc. for proper evaluation of their offers.

1.12 Extent of Work:

The work shall comprise of entire labour including supervision and all materials necessary to make a complete installation to the entire satisfaction of the Engineer-in-Charge. The term complete installation shall mean; not only major items of equipment covered by these specifications, but also incidental sundry components necessary for complete execution and satisfactory performance of the installation, with all labour charges, whether or not these have been mentioned in detail in the tender documents.

1.13 Completeness of tender:

All fittings, unit assemblies, accessories, hardware, foundation bolts, terminal blocks for connections, cable glands, miscellaneous materials and accessories necessary for efficient assembly and working of the equipment shall be deemed to have been included within the scope of work in the tender and within the overall details for complete items whether they have been specifically mentioned or not.

1.14 Certificate of compliance with or departure from specifications:

- (a) The tenderers who wish to depart from the provisions in these specifications or system engineering or the detailed requirements in Appendix-I, should list out such departure in the proforma indicated in Schedule 'D' of Appendix-I supported with complete particulars, technical reasons for departure and standards and test certificates. They should, however, quote rates strictly in accordance with the schedule of work in the documents and indicate separately changes in the quoted price due to their proposed departure.
- (b) The tenderer shall certify while submitting the offer that except the departure specifically mentioned by him, the work tendered by him shall comply in all respects with the tender specification. Unless this is done, the system shall be considered to comply in every respect with these specifications.

1.15 Drawings and manual to be furnished by the Contractor:

- (a) The contractor shall submit in duplicate the following drawings within a fortnight of the award of work for approval by the department:

- (i) Layout of detectors, manual call boxes and all other accessories.
 - (ii) Wiring diagram including connection topology for the complete system.
 - (iii) Circuit diagram of individual panels, P.A. system and detectors.
 - (iv) Constructional details of the various control and indicating panels and mimic diagram(s).
- (b) Before commencement of the installation:
- The above drawings, with observations of the Department duly incorporated, shall be submitted to the Engineer-in-Charge in triplicate along with any special instructions, with regard to handling, storage and installation.
- (c) 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 1.16.
 - (ii) Manufacturer's technical catalogues of all equipments and accessories.
 - (iii) Operation and maintenance manual of all major equipments, detailing all adjustments, operation and maintenance procedures.

1.16 Completion drawings:

Three sets of following laminated drawings shall be submitted by the contractor while handing over the installations 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 soft copy shall also be furnished.

- (a) Installation drawings giving complete details of all the components/items such as detectors, call boxes etc.
- (b) Line diagram and layout of all electrical control panels and work station.
- (c) Control wiring drawings with all control components and sequence of operation to explain the operation of control circuits.

1.17 Coordination with other agencies:

The contractor shall coordinate and cooperate with other agencies by exchange of all technical information as required, like details of weight, over all dimensions clearance and other technical data required for successful and proper completion of his portion of the work in relation to the work of others without any reservation. No remuneration should be claimed from the Department for such technical cooperation. Care shall be taken not to damage any structure. If any unreasonable hindrance is caused to other agencies and any completed portion of the works has to be dismantled and redone for want of the cooperation and coordination by the contractor during the course of work, such

expenditure incurred will be recovered from the contractor. If the restoration work is not carried out to the satisfaction of the Engineer-in-Charge the same shall be got done at his risk and cost.

1.18 Care of building:

Care shall be taken while handling and installing the equipment to avoid damage to the building. On completion of the installation, the contractor shall arrange to repair all damages to the building caused during installation so as to bring to the original condition.

1.19 Painting and protection:

Metal work of all equipment to be supplied (except the detectors) shall be given the final coat of paint over the primer after necessary treatment at the works before dispatch. All damages to painting during transport and installation shall be set right or repainted to the entire satisfaction of the Engineer-in-Charge before handing over.

1.20 Guarantee:

The contractor shall guarantee the entire FAS/ AFAS installation as per specifications both for components and for system as a whole. All equipments shall be guaranteed for one year from the date of acceptance against unsatisfactory performance or break down due to defective design, manufacture and/or installation. The installation shall be covered by the condition that the whole installation or any part thereof found defective within one year from the date of taking over shall be replaced or repaired by the contractor free of charge to the entire satisfaction of Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk & cost of the contractor.

The warranty shall cover the following:-

- (i) Quality strength and performance of materials used.
- (ii) Safe mechanical and electrical stress on all parts under all specified conditions of operation.
- (iii) Satisfactory operation during the maintenance period.
- (iv) Performance figures and other particulars as specified by the tenderer under schedule of guaranteed technical particulars.

1.21 After sales service:

The contractor shall ensure adequate and prompt after sales services in the form of maintenance personnel and spares as and when required with a view to minimize the break down period. Particular attention shall be given to ensure that all spares are easily available during the normal life of the installation.

1.22 Security Deposit & Performance Guarantee:

As per CPWD Works Manual amended up to date.

SECTION – 2

MANUAL CALL BOXES

2.1 Scope

This section covers the requirements of manual call boxes used in fire alarm system.

2.2 Constructional requirements:

- (i) The call box shall be of 1.5mm thick welded sheet steel or 3mm thick cast aluminium. The front face shall have a glass area designed to break by a steady application of pressure or by impact. Suitable arrangement like scratching by a diamond bit shall be incorporated in the frangible element so that when it breaks upon application of pressure by a finger, it does not hurt the finger.
- (ii) The frangible element shall keep a push button pressed inside such that in the event of breaking of the frangible element, the push button is released to actuate an alarm in the control panel. The push button shall be partly depressed so as not to hinder breaking of the frangible element.
- (iii) The call box shall have suitable knock out for termination of a 20mm conduit. This shall also have suitable provision for being fixed on surface or semi recessed in wall.
- (iv) Where sheet steel is used for call box, this shall be thoroughly cleaned off dust, dirt, grease and rust if any and two coats of anti rust primer shall be given both inside and outside followed by two coat of synthetic enamel paint in signal red colour or epoxy or powder coated after seven tank process.
- (v) In the case cast aluminium body for a call box, the surface shall be neatly finished with red colour paint as in (iv) above.
- (vi) The words 'FIRE' shall be printed on the front of the call box in face of window.
- (vii) The glass surface shall be minimum 30 sqcm in area and glass thickness shall not exceed 2 mm.

2.3 Installation requirement:-

- (i) Manual call boxes shall be installed at a height of 1400mm above the floor level.
- (ii) They shall be installed at easily accessible, well illuminated and conspicuous position, preferably in a contrasting background so that they are easily noticed from either direction. They should be semi-recessed so as to project minimum 10mm from wall surface.
- (iii) They shall be installed free from obstructions and shall not themselves obstruct exit way.
- (iv) It shall be located on escape routes at (inside or outside) each floor to escape stairs

- preferably near entry to staircases at various level.
- (v) It shall be located such a way that, no person in the premises needs to travel more than 30 meters to reach a manual call point to give an alarm.
 - (vi) Where necessary, the travel distance may be reduced to less than 30 meters e.g. where there is difficulty in access or in potentially dangerous risk areas.

2.4 Functional requirement:

Once the glass is broken the alarm shall sound on the floor as well as on control panel.

SECTION - 3

Automatic Fire Detectors

3.1 Scope:-

This-section covers the requirements of Automatic Fire Detectors of various types used in Automatic Fire Alarm System.

3.2 Choice of Fire Detectors :-

3.2.1 The Fire detectors are designed to detect one or more of following three characteristics of a fire:

- (a) Smoke
- (b) Heat
- (c) Radiation (flame)

3.2.2 No one type of detector is suitable for all applications. It is often useful to use a combination of different types of detectors. Choice of selecting a detector depends on the following:

- (i) The speed of response required.
- (ii) Need to minimize false alarms
- (iii) The nature of the fire hazard
- (iv) Other factors such as cost, suitability for environment, maintenance requirement etc..

3.2.3 The detector has to discriminate between a fire and normal environment.

3.2.4 Each type of detector responds to a different kind of fire e.g. with a slowly smoldering fire involving smoke, a smoke detector operate first. A fire that evolves heat rapidly with very less smoke operates heat detector first.

3.3 Types of Detectors:

The detectors shall be one or more of following types:

(A) Heat Detectors:

- (i) Fixed Temperature
- (ii) Rate of Rise-Cum-fixed temperature Detectors
- (iii) Probe type high temperature Bi-Metal Heat Detector
- (iv) Linear Heat Sensing Cables

(B) Smoke Detectors:

- (i) Ionization type

- (ii) Optical type
- (iii) Air Sampling type (Laser type Detector or high sensitivity detector)
- (iv) Multi-criteria Type
- (v) Photo-thermal Type
- (vi) Beam Detector
- (vii) Carbon Monoxide
- (C) Spark / Ember Detector**
- (D) Ultra Violet (UV) Flame Detector**
- (E) Infra Red (IR) Flame Detector**
- (F) Thermal Multi-Criteria Detector**

3.4 Governing Specifications:

- (i) Heat Detectors shall conform to IS-2175 - 1988 or BS-5445 (EN 54) Part 5 – 1977(VdS/LPCB approved) or NFPA72 (UL/ULC/FM approved) amended upto date.
- (ii) Smoke Detectors shall conform to IS-11360-1985 or BS 5446 Part I-1977 & Part VII – 1985 (VdS/LPCB approved) or NFPA72 (UL/ULC/FM approved) amended upto date.
- (iii) For other detectors/devices relevant IS or BS (EN 54) (VdS/LPCB approved) or NFPA 72 (UL/ULC/FM approved) amended upto date

3.5 Detectors & Applications:

3.5.1 Fixed Temperature Heat Detector:

The fixed temperature heat detectors are designed to operate when the temperature of detectors exceeds a predetermined value.

Application : Used where the ambient temperature is likely to fluctuate rapidly over short period e.g. in kitchen, boiler room, D.G. Set room, Non AC. area in building.

3.5.2 Rate of rise-cum-fixed temperature detectors:

These detectors are designed to operate within a given time.

- When the rate of temperature rise at the detector exceeds a predetermined value regardless of the actual temperature.
- When temperature at detector exceeds a predetermined value

Application -

In areas subject to smoke, dust and dirt during normal use, where smoke detectors cannot be used.

3.5.3 Probe type High Temperature Bi-Metal Heat Detector:

The detector are reset type and highly suitable to use above 80°C where electronic components cannot be used.

Application: Generator Enclosure, turbine enclosures, oven and furnace area etc.

3.5.4 Linear Heat Sensing Cables:

These can be broadly divided into two categories; digital and analogue, depending upon the principle by which the sensing cable registers a change in temperature.

Digital sensor consists of two core cable in which the conductors are separated by a heat sensitive insulator. When a specified temperature is reached, the cable insulation breaks down and an alarm is activated.

In analogue sensor, cores are separated by a negative temperature co-efficient polymer whose resistance reduces in proportion to temperature increase.

Applications: These cables are used for detecting fire and overheating in following areas:

- (i) Cable tunnels, trays and vaults
- (ii) Material conveyors
- (iii) Bulk storage mull - racked areas
- (iv) Rim seals of floating roof tanks storing hazardous chemicals.

3.5.5 Ionization smoke Detector

Good for invisible smoke detection. Due to use of radioactive element present in it, the disposal is a great problem and can cause serious health hazard, hence now slowly becoming obsolete, use of this detector may be avoided.

3.5.6 Optical Smoke Detectors

The optical smoke detector is based on Light Scattering principle. The LED (Light Emitting Diode) transmits light to the measuring chamber where it is absorbed. In case of fire, smoke enters the measuring chamber and the smoke particle scatter the light. The amount of light reaching to photo diode is converted into a proportional electrical signal. On operation of detector when the electrical signal reaches a predetermined threshold value it triggers the alarm on control panel.

Use: More suitable for smoldering fire which produces mainly larger particle of smoke e.g. burning of PVC, in A.C. area in a building.

3.5.7 Air sampling type detector (High sensitivity smoke detector)

Laser type smoke detectors are used in this type of system. Detector consists of a piping or tubing distribution network that runs from the detector to the areas to be protected. An aspiration fan in the detector housing draws air from the protected area back to the detector through air sampling ports, piping or tubing. At the detector, the air is analyzed for the products by the laser based smoke detector.

Use : Typical application of the system is in places where trace of smoke needs to be detected and high airflow can make traditional smoke detector inadequate.

3.5.8 Spark / Ember Detector

This detector uses a solid state photodiode or photo transistor to sense the radiant energy emitted by embers typically between 0.5 microns and 2.0 microns in normally dark environments.

These detectors can be made extremely sensitive (microwatts) and their response times can be made very short (microseconds).

Applications :

The detectors are primarily installed to detect sparks and embers that could, if allowed to continue to burn, can cause a much larger fire or explosion.

The detector is mounted on some form of duct or conveyor, monitoring the fuel as it passes by. It is necessary to enclose the portion of the conveyor where the detectors are located, as these devices generally require a dark environment.

3.5.9 Ultra-Violet (UV) Flame Detector:

It makes use of ultra violet sensitive photocathode for detecting flame. It has very high sensitivity and low false alarm rate and is suitable for indoor application.

The detector is not suitable for high ceiling as the radiation from fire is attenuated by smoke. The random UV radiation from sources such as lighting, the Arc welding etc. can cause false alarms hence usage in such areas to be avoided.

3.5.10 Infra-red flame detector:

Almost all the materials that participate in the flaming combustion emit ultraviolet radiation to some degree during flaming combustion whereas only carbon containing fuels emit significant radiation at 4.35 micron (Carbon dioxide) band used by many detectors to detect a flame. This detector senses wave length in the infrared spectrum.

Application:

- (i) High-ceiling, open-spaced buildings such as ware-houses and aircraft hangers
- (ii) Outdoor or semi outdoor areas where winds or draughts can prevent smoke from reaching a heat or smoke detector.
- (iii) Where rapidly developing flaming fire can occur such as in petrochemical production areas, storage areas, natural gas installations, paint shops or solvent areas.

Some of the extraneous sources of radiant emissions that have been identified as interfering with the stability of flame detectors include the following:

- (a) Sun Light
- (b) Lightning

- (c) X-rays
- (d) Gamma Rays
- (e) Cosmic Rays
- (f) Ultraviolet radiation from welding
- (g) Electromagnetic interference
- (h) Hot objects
- (i) Artificial lighting

3.5.11 Photo - Thermal Multi-criteria detector

This detector combines optical smoke and heat detection and is capable of being used as a smoke and heat detector both. The multi criteria detector shall be able to discriminate between non-threatening deceptive phenomenon such as cigarette smoke and actual fire hazards. This avoids nuisance alarm.

Application: This is good for smoldering and fast flaming fires, optically dense smoke and can be used in buildings for AC and Non-AC area.

SECTION - 4

CONTROL AND INDICATING PANELS & PA SYSTEM

4.1 SCOPE:

This section covers the requirements of the various Control and indicating panels used in Fire Alarm System and Public Address System.

4.2 Type of control and indicating panels:

Following are the types of control indicating panels in a FAS/AFAS. These shall be provided as specified in the schedule of work.

- (i) Main control and indicating panel (C & I Panel) including Public Address System.
- (ii) Sector Panel.
- (iii) Zonal Panel.
- (iv) Repeater Panel.

4.3 Functional requirements:

4.3.1 General:

The trigger devices shall be connected to the respective zonal panels. Where the zoning design in any work provides of areas as sector and further sub-division as zones, the trigger devices shall be connected to the sector panels, since no zonal panel is required in such a case. The sector/zonal panels shall in turn be connected to the C&I Panel. The C&I panel shall provide necessary audio-visual alarm and actuate the sounders. This shall also initiate signals for any other operation specified in tender specification. Electric power supply to the entire FAS/ AFAS shall be fed through this panel.

4.3.2 C & I Panel including Public Address System

- (i) All the sectors/zones connected to this panel shall be continuously monitored.
- (ii) Audio-visual alarm shall be provided in this panel to show the ZONE affected by fault in its wiring system or by fire. Such an alarm should be separate for fault and fire conditions. (See also 4.4.2)
- (iii) This shall be complete with necessary circuitry for providing power supply to the entire FAS/AFAS drawing power from the mains/standby battery.
- (iv) This shall transmit to its repeater panel if any, signal of alarm of fault and of fire.
- (v) This shall be so designed that the audio alarm activation and silencing shall be as indicated in Section-5 (Part-A).

- (vi) Public Address System shall be provided to enable transmission of announcements and instructions to the occupants in each zone in the event of a fire.
- (vii) Fire alarm sounders in the premises shall be designed to function as loud speakers for the purpose. The microphone, necessary amplification equipment and control switches shall be provided as a part of the C&I panel.
- (viii) The power rating and frequency response shall be as per the requirement of the individual installation.

4.3.3 Sector/zonal Panel:

- (i) A sector panel shall be provided where there is more than one zone in a floor under the control of a C&I panel, and zonal panel is not required in that floor. A zonal panel shall be provided where there is only one zone in that floor.
- (ii) The sector/Zonal panel shall provide visual indication of the ZONE where a fault or fire has occurred. (See also 4.4.3) Audio alarm in this panel shall be provided, where specified in tender specifications.
- (iii) This panels shall transmit to the C&I panel, alarm signals from any of the trigger devices and the wiring connected to it.

4.3.4 Spot Indicator:

This shall provide only a visual indication whenever any of the detectors connected to it triggers a fire alarm.

4.3.5 Repeater panel:

A repeater panel where provided shall duplicate the alarm indications (audio as well as visual) of the C&I Panel.

4.4 Constructional requirements:

4.4.1 General design & fabrication:

- (i) The various control and indicating panels shall be totally enclosed, dust and vermin proof and shall be suitable for the environmental conditions at the site of their installation.
- (ii) These shall be fabricated out of sheet steel of 1.6mm thickness and designed for wall or floor mounting. They shall be front openable type with hinged cover and lock.
- (iii) The C & I Panel shall be designed such that the equipment for power supply, battery charging and P.A system for FAS/AFAS are housed in independent compartments. Maintenance free batteries shall however not be accommodated inside the panel to avoid problems due to corrosion.
- (iv) Suitable knock outs shall be provided for the entry of cables and wiring into the panels.

- (v) The panels after fabrication shall be cleaned to remove any dust/dirt/grease/rust and phosphated. After two coats of anti-rust primer, the panels shall be finished with powder coating of fire red colour.
- (vi) All components and their wiring shall be arranged so as to be conveniently attended to from the front of the panels.
- (vii) All indicating lamps, control switches and buttons and fuses shall be located in the front of the panels. These shall be suitable and unambiguously labeled.
- (viii) The indicating lamps should consist of LED conforming to relevant Indian standards, connected in parallel, of following colours:
 - (a) Red to indicate FIRE condition - Two LED
 - (b) Amber to indicate FAULT condition - only one LED i.e. for open & short circuit separately.
 - (c) Green to indicate HEALTHY condition.
- (ix) Test buttons to test the indicating lamps shall be provided.
- (x) All control and indicating panels can be of either electro-mechanical type or of electronic type.
- (xi) Any printed circuit boards (PCBs) used in the panels shall be plug in type. The PCBs shall be suitably protected against atmospheric corrosion.
- (xii) If required, the panel should have additional capacity to operate auxiliary equipment like fire dampers, fire closers, ventilation and/or pressurizing fans, smoke exhaust fans etc.

4.4.2 C & I Panels.

- (i) Audio-visual indication shall be provided in this panel for the following:
 - (a) Fire in any zone
 - (b) Fault in any zone including fault in wiring to the sector/zonal panels and removal of any fire detector/disconnection of leads to detectors.
 - (c) Fault in this panel itself.
 - (d) Mains supply failure.
 - (e) Low battery voltage.
 - (f) A.C. Fuse blowout.
 - (g) D.C. fuse blow out.
- (ii) Only visual indication shall be provided in this panel for the following:
 - (a) A.C. Power ON/OFF.
 - (b) Stand by battery supply ON/OFF.

- (c) Battery charger ON/OFF.
 - (d) Isolation of zone for testing purposes as per (iii) below.
 - (e) Operation of silencing switch, when there is no alarm condition.
 - (f) P.A. system ON.
- (iii) Facility shall be provided to test the zones individually by simulating fault or fire condition. Each zone shall be capable of isolation for maintenance or test purposes leaving the remaining zones in healthy condition so that fire detection in those zones is not affected. Visual indication of such isolation shall be available on the panel.
- (iv) This panel shall also be provided with the following:
- (a) Necessary test switches for testing of circuits and C&I panel.
 - (b) Panel sounder and silencing switch.
 - (c) Switches to operate the fire alarm sounders zone wise and also collectively at all zones.
 - (d) Changeover switch to P.A. System.
 - (e) P.A. System equipment and panel microphone.
 - (f) Voltmeters with protective fuses for both A.C. and D.C. Supplies.
 - (g) Battery charger ammeter.
- (v) On clearance of a fault or a fire condition, as the case may be the system shall reset automatically.
- (vi) Where specified, the following provisions shall be incorporated in the design of the C&I panel:
- (a) Provision for automatic connection to Fire Brigade through external public telephone lines.
 - (b) Provision for operation in conjunction with other Gas based Suppression System.

4.4.3 Sector/Zonal Panel:

- (i) This panel shall provide visual indication for the following:
 - (a) System ON and healthy.
 - (b) Fault in any zone connected to this panel.
 - (c) Fire in any zone connected to this panel with double lamp arrangement.
 - (d) Isolation of a zone for testing purposes from C&I panel.
- (ii) Test switch shall be provided to test the lamps on this panel.

- (iii) Where audio alarm is specified in tender specifications in any work in this panel, panel sounder and its silencing switch shall be provided.
- (iv) The power supply to operate this panel shall be drawn from the C&I panel.

4.4.4 Spot indicator:

- (i) The indication given out by these indicators shall be conspicuous under fire conditions. In case of recessed type, the design shall be such that the indicators are spotted easily.
- (ii) The cover of the spot indicators may be screwed type or snap-in-type.

4.4.5 Repeater Panel:

- (i) All indications, both visual and audio as shown on the C&I panel shall be indicated in the repeater panel, where provided.
- (ii) The power supply to operate the repeater panel shall be drawn from the C&I panel.

4.5 Installation requirements:

4.5.1 Location:

- (i) No control and indicating panel shall be located outside the building room in severe environmental conditions, unless precaution against the effects of the same have been taken.
- (ii) These panels shall not be provided inside any enclosed space and preferably be located somewhere on the ground floor / in fire control room.
- (iii) The C&I panel shall be conspicuously located so as to be visible without effort on entering a building.
- (iv) The sector/zonal panel shall be located in a conspicuous location at the entrance to a sector/zone, such as a lift lobby or a staircase lobby. This panel shall be in a common lobby or a corridor, which can be approached without passing through an occupied area.
- (v) The repeater panel should be provided near the main entrance so that maintenance staff notices the fault condition or isolation if any for rectification.

4.5.2 Installation of control and indicating panels:

- (i) The control and indicating panels shall be installed at the locations decided in conformity with 4.5.1 above and shown in the drawings approved by the department. Mimic diagram shall be installed by the side of the C&I panel so as to be integral part of the same.

- (ii) Depending on the size and design of these panels, they may be either wall mounting or floor mounting type. Installation shall be done using necessary foundation bolts etc.
- (iii) Any supports required for large panels shall be of sufficient strength so that installation is rigid and sturdy.
- (iv) Necessary provisions shall be made for conveniently receiving conduits or cables as the case may be.
- (v) The panels shall be so installed that all the indicator lamps are easily visible and the switches in the panels are within easy reach for operation.
- (vi) A free working space of at least 1 meter shall be available in front of the panels.

4.5.3 Installation of spot indicators:

- (i) Spot indicators shall be installed on wall such that its top is at door level and by the side of the entrance to the respective premises.
- (ii) Spot indicators for detectors installed over a false ceiling in a corridor shall be installed directly under the false ceiling.
- (iii) Spot indicators for detectors installed under a false floor, shall be installed at a height of 1 meter above false floor level. Additionally, a marking or an arrow pointing downwards shall be made by the side of the spot indicator.
- (iv) The installation shall be such that the visual indication from the spot indicators are conspicuous and that the affected area is spotted without difficulty.

4.5.4 Silencing of Fire Alarm:

The alarm should operate until silenced manually. The alarm should not be silenced automatically.

SECTION-5

SOUNDERS AND SILENCING SWITCHES

5.1 SCOPE

This section covers the requirements of sounders and silencing switches used in fire Alarm System/Automatic Fire Alarm System.

5.2 Type of Sounders:

Sounders in a FAS/AFAS shall be of the following types:

- (i) Panel sounders.
- (ii) Fire alarm sounders. These in turn comprise of low intensity and high intensity Sounders. These shall be provided as specified in the schedule of work. The sounders for fire alarm should be electronic hooters/horns/electric bell.

5.3 Functional requirements:

- (i) Panel sounder shall be provided in C&I Panels, sector/zonal panel specified and repeater panel if any so as to draw attention of the care taking personnel in a building to a fault in the FAS/AFAS wiring and a fire condition in the protected premises.
- (ii) Fire alarm sounder of low intensity type shall be installed to signal to the occupants of the building to evacuate in the event of a fire.
- (iii) Fire alarm sounders of high intensity type shall be installed to draw the attention of the fire fighting personnel toward the main entrance of the premises where a fire has erupted.
- (iv) Fire alarm sounders shall not be used for any purpose other than for fire operations.
- (v) Silencing facility shall be provided, only for panel sounders and not for fire alarm sounders.

5.4 Operation of sounders and silencing:

- (i)
 - (a) Panel sounders shall be actuated from the respective panels except in repeater panel, in which this shall be actuated from the C&I Panels.
 - (b) Fire alarm sounders shall be actuated from the C&I Panel.
 - (c) The operation of sounders shall be independent of operation of any indication like lamps or flags in the panels.

- (ii) The panel sounders in the respective panels shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device connected to them. These shall be sounded when there is a fault alarm signal within their areas of control.
- (iii) A silencing switch shall be provided in C&I Panel. Operation of this switch shall mute the audio output from the panel sounder in this panel and in its repeater panel, if any. Silencing switch shall also be provided in repeater panel which when actuated shall mute the audio output in the panel only. Silencing switch shall be provided in sector/zonal panels which may be specified to have audio indication in particular works, to mute the output of the same.
- (iv) Fire alarm sounders in a zone affected by a fire shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device in that zone. All other fire alarm sounders shall be actuated only manually from the C&I Panel, individual zone-wise and collectively for the entire installation. (Automatic operation of all the sounders in a building immediately after a fire alarm signal is initiated is likely to create panic). Such a manual operation of Fire alarm sounders be done after operating the silencing switch for the sounder in the C&I Panel, within a preset time.

5.5 Specification requirements:

5.5.1 Sounders:

- (i) Hooter shall be provided for both panel sounders and fire alarm sounders. Bell may be provided as low intensity fire alarm sounders, only where so specified.
- (ii) The frequency of sound from sounders shall lie in the 500-1000 Hz band. The sound level shall be at least 65dB(A) or 5 dB (A) above any other noise likely persists for a period longer than 30 second at any part of the building. Sounders with a level greater than 120 DB(A) shall not be provided.
- (iii) The sound shall be continuous although the frequencies and amplitude may vary and of the same characteristics from the fire alarm sounders in a building. Coded fire alarm signaling from sounders shall not be provided which may cause hearing damage.
- (iv) 'Fault alarm' and 'Fire alarm' in a panel sounder shall be distinctly different.

5.6 Silencing switches:

- (i) Silencing switch shall be in the form of a switch or push button.
- (ii) This shall be located on the panel whose panel sounder is to be silenced.
- (iii) Operation of a silencing switch shall not affect any visual indication nor the output of fire alarm sounders in the building.
- (iv) Operation of a silencing switch shall not prevent the receipt of alarm from any sector/zone as the case may be, not already in an alarm condition.

5.7 Installation requirements:

- (i) Low intensity fire alarm sounders may be installed on surface of ceiling, suspended from ceiling or recessed in flush with the ceiling, depending on the construction of the sounder and ceiling height.
- (ii) These shall be installed at a height not lower than 2.4m except when recessed in a false ceiling of lower height. In such cases the sounders shall be recessed at false ceiling level.
- (iii) When installed flush with a false ceiling these shall match the ceiling surface. Necessary provisions for frame work to accommodate the sounders shall be made in the ceiling in advance.
- (iv) High intensity sounders shall be mounted on substantial supports. Provisions for terminating the electrical wiring cables shall be such as not to permit entry of rain water through the wiring conduits or cable runs.

SECTION-6

MIMIC DIAGRAM

6.1 SCOPE:

This section covers the requirements of mimic diagram to be provided as part of a Fire Alarm system/Automatic Fire Alarm System.

6.2 Mimic Diagram.

- (i) A clear indication of the locations of all the ZONES shall be provided in mimic diagram.
- (ii) Mimic diagram shall be provided near Main Control Panel and near repeater panels.
- (iii) A topographical representation of the premises shall be provided in the mimic diagram for the purpose.
- (iv) The construction shall be in a metal frame work wall mounted, with a facia of transparent acrylic sheet with lighted and labeled (or engraved) indications.
- (v) The location shall be well lighted so that the mimic diagram is conveniently readable.

SECTION-7

POWER SUPPLY EQUIPMENT AND WIRING

7.1 SCOPE:

This section covers the requirements of power supply equipment for the Fire Alarm System /Automatic Fire Alarm System and the wiring for the system.

7.2 Main Supply

Power supply at 230 V 50 Hz, A C. single phase shall be provided terminating directly into the incoming switch of the C & I panel. Earth wire shall be provided with the power supply. Rectification of the input AC supply into DC and further stabilization of the voltage as may be necessary shall form part of the FAS equipment.

7.3 Standby battery supply

7.3.1 Standby battery shall be provided with C&I Panel.

7.3.2 Battery supply shall be arranged to automatically feed the FAS/Automatic Fire Alarm System in the event of variation of input A.C. voltage beyond preset values on high and low sides.

7.3.3 The battery shall be sealed maintenance free lead acid type or any other rechargeable type. The nominal voltage shall be as suitable for the FAS/AFAS The capacity of the battery Shall be such that it should capable of maintaining the system in normal operation for a Period of not less than 24 Hours after failure of normal supply.

7.3.4 Installation

Battery shall be located in a well ventilated space close to the C & I Panel, so as to be conveniently maintained. This shall be installed in a non corrosive enclosure, such as of wood, PVC or steel coated with epoxy paint

7.4 Battery Charger

7.4.1 The battery shall be provided with a matching battery charger which shall form part of the C&I Panel. The battery shall be in continuous trickle/boost charge.

7.4.2 The charging rate shall be such that after re-charging for a period of 8 hours, the battery shall be capable of feeding load for the capacity specified in the schedule of work.

7.4.3 The charger shall be complete with necessary voltmeter, ammeter, indicating lamps, fuses, etc.

7.5 Wiring for FAS/AFAS

7.5.1 Circuit Design:

- (i) The design of the System wiring shall match the manufacturer system design.
- 7.5.2 Wiring/Cables:**
- (i) The PVC insulated FRLS copper conductor cable having a minimum 1.5 mm² cross sectional area confirming to IS-694 to be used.
 - (ii) Armoured XLPE cables confirming to IS 7098 Part-1, 1988 with upto date amendments shall be used for connection with control panels & other areas wherever required.
 - (iii) Wiring shall be laid in metallic/rigid conduit.
 - (iv) Cables connected to detectors should be given 'S' loops on both the sides of the detectors which should be properly clamped to the ceiling. Loop should also be left, where wire/cables connect to sounders & all other accessories in the system. Appropriate glands should be provided where the cables enters the junctions box.
 - (v) Only 'red colour' wire should be used for laying in conduit.
 - (vi) No over head lines should be used to connect different building.
 - (vii) All the wires should be tagged for proper identification, should be identified by ferrules at junction & cable by colour bands at every 3 meters distance.
 - (viii) Multi-core cables and flexible cords shall not be used.
- 7.5.3 Installation requirement:**
- (i) The electrical work connected with a FAS/ AFAS shall be carried out in conformity with CPWD General Specification for electrical work Part-I (Internal) 2013 and Part-II (External) 1994 both amended up to date.
 - (ii) FAS/AFAS wiring shall be exclusive to the FAS/AFAS and be physically separated from wiring for any other service in the building.
 - (iii) To minimize possible disruption due to fire or other cause, fire alarm circuits should be separated as much as possible from each other. Where practicable, the different fire alarm circuits shall be run through different routes.
 - (iv) The metal body of all control and indicating panels shall be loop earthed using 2.5 sqmm copper wire and bonded to the earthing system in the building.

PART-B

**INTELLIGENT ADDRESABLE
FIRE ALARM SYSTEM**

SECTION-1

INTRODUCTION

Intelligent Addressable Fire Alarm System General & System Engineering

The latest development in fire alarm system, Detectors Technology is Intelligent Addressable Fire Alarm System over conventional system. It is now become almost necessary to install this system in every functional and important building because the system has many advantages over conventional automatic fire alarm system such as:

- (i) Accurate quick response to emergencies.
 - a. Early fire warning
 - b. Individual Device identification / location
 - c. Analog Signal feed back
 - d. Pre-alarm notification
- (ii) Eliminates nuisance alarms
- (iii) Powerful operator interface
- (iv) Reliable
- (v) Advance on line diagnostics i.e.
 - a. Continuous circuit supervision
 - b. Detection and isolation of faults
 - c. Continuous processing of analog value sensor data
 - d. Maintenance diagnostics
 - e. Panel test
 - f. Control Board self test
- (vi) Reduction in maintenance costs by:
 - a. Remote testing and sensitivity adjustment.
 - b. Panel testing of smoke sensor to meet International Standard.
 - c. Individual sensor cleaning on need based only.
- (vii) Flexible application

An intelligent addressable fire alarm system is provided to effect total control over the life safety services required in the building. The system is provided with addressable and analog fire alarm initiating, annunciating and control devices. The system is such that smoke

sensors/detectors, thermal sensors/detectors and manual call points etc. can be identified with point address. The system is capable of:

- (a) Setting smoke sensor sensitivity remotely on a pre-programmed sequence. The system is able to recognize normal and alarm values that reveal trouble condition, pre alarm or need of maintenance.
- (b) Provide a maintenance / pre-alert capability at smoke sensors to prevent the detectors from indications a false alarm due to dust, dirt, etc.
- (c) Provide alarm verification of individual smoke sensors. Alarm verification printed on the in-built printer of the main fire alarm panel on the external printer attached.
- (d) Provide outputs that are addressable i.e. output have a point address to be set from the main control station. The operator is able to assign such points to logical point groups (software zones) for pre-programmed operation.
- (e) In the event of fire alarm but not in a fault condition, the exact location is shown on the main fire alarm panel, local sounder automatically sounded; the complete information is printed along with time and date of occurrence. Air handling units on the effected zones is automatically switched OFF and simultaneously respective fire dampers are closed. Pressurization fans on the evacuation shafts i.e. stairwells, etc. are automatically switched ON. All system output program assigned via control-by-event programs that are activated by a particular point in the alarm are executed, and the associated system output (alarm notification appliance and/ or relays) are activated. The audio portion integrated to the system directs the proper signal (tone or Voice) to the appropriate speaker circuits. Pre-recorded alarm messages are played on the public address system.
- (f) All the loop elements are able to isolate the short circuits on the loop wiring and thus no element is isolated in the event of single short circuit and the exact location of the short circuit is indicated on the respective fire alarm panel.
- (g) The fire alarm panels have necessary interface units for intelligent addressable detectors alarm output modules for external actuations through fail safe programmable relays and communication interface.
- (h) Fire alarm management system in an intelligent addressable Fire Alarm and Detection System comprises of Graphical Management System which is multi-user, with a lot of facilities. It has two screen display the left screen dedicated to display the graphic (building floor plans, Alarm panels etc.) and the right screen lists all events (alarm reports , Fault messages, information about disable detectors etc.)
- (i) Building management system provides bidirectional monitoring and operation of the attach devices of the Fire Alarm and Detection Systems. Besides, other components/ devices in the building like AHU's Pressurization Doors , lifts etc. can also be monitored and operated from the graphical fire alarm management software.

SECTION-2

MANUAL CALL POINTS

2.1 Scope

This section covers the requirements of manual call points (MCP) used in addressable intelligent fire alarm systems.

2.2 Constructional requirements of:-

- i. It is used to trigger a fire alarm manually, and should be suitable for connection to the system loop technology. The alarm is raised by breaking the glass with the alarm carrying on until a replacement glass panel is fitted or alarm to be made silent from control panel. Suitable arrangement like scratching by a diamond bit shall be incorporated in the frangible element.
- ii. A micro switch within the units is held "off" by the edge of the glass when glass is broken the switch is released and a signal is transmitted to control panel where the alarm is raised. The glass is preferably plastic coated to eliminate the damage of splinters causing injury.
- iii. For testing without breaking the glass a test key, should be available so as to lower or remove the glass to release the micro switch. Full functional test is achieved accordingly.
- iv. Facility for reset/adjustment of manual call point alarm triggering.
- v. The unit shall be made out of polycarbonate ABS blend with flame retardant & self extinguishing properties or cast aluminum or ASA plastic or as per manufacturer design and applicable standards.
- vi. It shall preferably contain an integrated short circuit isolator which should ensure that a fault is localized and that the loop continues to function fully in the event of a wire break or a short circuit.
- vii. The call box shall have suitable provision to knock out of termination of a 20mm conduit. This shall also have suitable provision for being fixed on surface or semi recessed in wall.
- viii. The word 'FIRE' shall appear embossed in red color on the front.
- ix. Acknowledgement LED displays –red for triggered alarm indication (flashing) and / or maintenance evacuation.
- x. Protective category shall be IP54 for indoors & IP65 for outdoors applications.

2.2.1 Installation Requirements

Same as given in Part 'A' for conventional type system.

SECTION-3

INTELLIGENT ADDRESSABLE FIRE DETECTORS

3.1 Scope

The section covers the requirement of automatic intelligent addressable fire detectors.

3.2 Type of Detectors

Same as given in section 3 Part 'A'

3.3 General Features common to all Detectors:

3.3.1 Built-in-response Indicator:

Each detector shall incorporate indicator "LED" at the detector which shall blink on actuation of the detector to locate the detector which is operated while on fire. The detector shall not be affected by the failure of the response indicator lamp.

3.3.2 The detector shall have preferably 360° visible view of the alarm LED or twin LEDs blink whenever detector is addressed.

3.3.3 The detector shall have preferably with integrated built in short circuit isolator or as per manufacturer design so that in case of any short circuit in the detector, the detector can be isolated so that loop should be able to retain the full functionality or in case built in short circuit isolator not available/ provided by the manufacturer a fault isolator unit shall be provided after every 20 detectors/ devices in a loop. But in later case isolator unit shall ensure that the loop is functional except the faulty detector.

3.3.4 The detector shall be with IP 54 protection category with base.

3.3.5 The detector shall be with built in microprocessor capable of making alarm on control panel based on the information stored in detector.

3.3.6 The detector shall confirm to international standard i.e. NFPA/EN or equivalent.

3.3.7 The detector shall provide electronic address setting by means of configuration software.

3.3.8 The detector shall be plug-in-type and shall have common base to facilitate exchange for cleaning & maintenance. The base of the detector shall be interchangeable with other smoke detectors.

3.3.9 The detector shall be supplied fully tested and each detector should bear the SI. No. and seal of the approving laboratory/body.

3.3.10 The detectors, device including response indicator and control panel shall be of same make.

3.3.11 Reversed polarity or faulty zone wiring shall not damage the detector.

- 3.3.12 The detector shall be suitable for column/ceiling mounting.
- 3.3.13 The detector should have static voltage over load protection.
- 3.3.14 The detector shall be individually identifiable from the control unit by geographical location in the system.
- 3.3.15 The detector shall connect to the local control unit via a fully supervised two wire circuit.
- 3.3.16 The detector shall be inserted into or remove from the base by a simple push twist mechanism with an appropriate tool.

3.4 Addressable Beam Detector (Infra-red light detector)

- (i) The Beam Detectors shall be long range, projected beam type smoke detectors which consist of a separate transmitter and receiver and evaluating unit integrated into a compact housing.
- (ii) The transmitter shall emit an invisible pulsed infra red beam to receiver when beam is obscured beyond selected threshold (20%, 30%,.....70% obscuration) by smoke, the receiver shall signal an alarm. If the beam is completely blocked, receiver shall signal a trouble.
- (iii) It shall provide selectable sensitivity and alarm response time for flexibility of installations.
- (iv) It shall have a range coverage from 9 mtrs. to 100 mtrs. with upto 16-17 mtrs. spacing between adjacent detectors on smooth, flat ceilings.
- (v) It shall have automatic environment compensation.

3.5 Addressable Heat Detector:

Type of Heat Detectors as given in para 3.3, 3.5.1, 3.5.2, 3.5.3 & 3.5.4 (Section-3 Part A) except the following:

- (i) The detector and transmission electronics in the detector head for easy exchange in the event of malfunction. Therefore no electronics are permitted in base.
- (ii) It has maximum triggering temperature programmable from 58^oC to 81^oC.
- (iii) It has high level of immunity to electromagnetic influences.
- (iv) The alarm signal when limit temperature is reached is given in Para (ii) above.
- (v) Automatic addressing during initial set up or exchange of the detector, without making adjustment of detector.
- (vi) Adjustment of the maximum temperature value in combination with or without the temperature differential value.
- (vii) Theft protection to protect against unauthorized removal of the detector from base can be available.

3.6 Addressable optical- Thermal (Multi Criteria Detector):

1. The intelligent multi criteria detector shall have photo electric and thermal technologies in a signal sensing device.
2. The device shall include to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react in the event of a fire condition.
3. It shall have an ability to distinguish between a fire condition and a fire alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to database of actual fire and deceptive phenomena.

Use:

- (i) These detector shall be utilized for slow smoldering fire.
- (ii) The microprocessor shall be capable of selecting the appropriate sensitivity levels based on the environmental conditions, it can be in office, manufacturing unit, kitchen etc. and have the ability to automatically change the setting as the environment changes.

3.7 Intelligent Duct Smoke Detectors

- (i) The smoke detectors housing shall accommodate either an intelligent ionization detector or an intelligent photo electric detector of that provides continuous analog monitoring and alarm verification from the panel through a control module in the loop system.
- (ii) When sufficient smoke is sensed in the return air coming to AHU (Detector unit has to be installed in return air path) an alarm signal is initiated at FACP to close the fire damper and prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by duct system.

Note : Various types of detectors their use and applications are same as given in Section 3 of Part –A

3.8 Detector Base:

- (i) The detectors of all types shall fit into a common type of standard base.
- (ii) Once a base has been installed, it shall be possible to insert, remove and exchange different types of detectors by a simple push & twist movement.
- (iii) The standard base shall be equipped with screw less wiring terminals suitable for securing wire size upto 1.5sqmm and with built in strain limits to prevent permanent terminals deformation and weakening of contact pressure.
- (iv) It shall have a sealing plate, prevent dirt, dust condensation or water from the conduit reaching the wire terminals of the detector contact points.
- (v) All standard base shall be supplied with a removable dust cover to protect the contact area during installation and construction phase of the building. It must allow the inspection and verification of the zone wiring before insertion of any detectors.

- (vi) The standard base shall have a built in mechanism, which allows mechanical locking of any installed detector head, thus preventing unauthorized removal or temperin while maintaining.
- (vii) Reversed polarity or faulty zone wiring shall not damage the detector.

3.9 Intelligent Addressable Monitor Module

- (i) The module shall be suitable to monitor the polling of up to minimum four potential free contacts by using a single or multiple housing and designed for surface or flush mounting.
- (ii) The operating mode can be selected and is assigned separately for each input the addressing of the module and the setting of parameters should be carried out using PC software, via the fire alarm control panel.
- (iii) The module should contain an integrated short circuit isolator which ensures that the fault is localized and the loop continues to function fully in the event of a wire break or a short circuit.
- (iv) The module should be minimum IP 40 protection category when housed in a case or as per manufacturer design.
- (v) The module should be with soft addressing to be set with a PC via fire alarm panel at the time of programming.
- (vi) The module should have integrated buzzer force signaling maintenance alarms.
- (vii) An LED shall be provided that shall flash under normal condition indicate that module is operational.

3.10 Intelligent Addressable Relay / Control Module

- (i) Relay module may contain upto four relays each with a potential free changeover contact.
- (ii) Each relay contact should be FAIL/ SAFE programmable, means it should be possible to program each contact to operate in three conditions viz. NO FIRE CONDITION, FIRE CONDITION AND LOOP POWER FAILURE CONDITION.
- (iii) Both the addressing of the module and setting of parameters to be carried out using PC software via the fire alarm control panel.
- (iv) The module contains a short circuit isolator, which ensures that the fault is localized and that the loop continues to function fully in the event of a wire break or a shot circuit.
- (v) The module should be minimum with IP 40 protection category when housed in a case or as per manufacture design.
- (vi) It should have integrated buzzer for signaling maintenance alarms.
- (vii) Its housing have is designed for surface or flush mounting.

3.11 Isolator Module:

- (i) The module shall limit the number of module of detectors that may be rendered inoperative by a short circuit on the loop segment.
- (ii) At least one isolator module shall be provided for each floor or protected zone of the building.
- (iii) If a wire short circuit occurs, the isolator module shall automatically open circuit (disconnect) the loop. When the short circuit condition is corrected, the module shall automatically reconnect the isolated section.
- (iv) The module shall not require any address setting and its operation shall be automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- (v) It shall give information on the control panel in the form of audio- visual alarm enunciations along with list of detectors which have become non-functional.

Section-4

Addressable Fire Alarm Control Panel

4.0 Scope :

This section covers the requirements of main fire alarm, control panel, repeater panel, graphical management system, response indicator etc. used in addressable fire alarm system.

4.1 Functional Requirement.

4.2 General

- i. In the event of fire alarm but not in a fault condition, the exact location shall be shown on the Main Fire Alarm Panel (MFAP).
- ii. Local sounder should sound automatically.
- iii. Complete information shall be printed with time and date of occurrence.
- iv. Air handling units on the effected zones shall be automatically switched OFF and respective fire dampers shall also be closed.
- v. Pressurization fans of staircase shall automatically be switched ON.
- vi. The audio portion integrated to the system shall direct the proper signal (tone or voice) to the appropriate speaker circuits.
- vii. Pre-recorded alarm messages shall be played on the Public Address System.
- viii. The panel shall have the facility to process the input signals and control the output functions either directly or through interface modules as per the requirements.
- ix. The panels shall have necessary interface units for addressable detectors alarm output modules for external actuations through fail safe programmable relays.
- x. The processor shall interact with the other modules through a common bus.
- xi. The system shall store all basic information and job specific data in memory.
- xii. Different password shall protect any change to system operations.
- xiii. The design of the panel hardware and software shall incorporate the capability to accept additional input from fire protection system such as sprinkler and water flow switch, operation of fire dampers, pressurization fans etc.
- xiv. The panel shall have an extra loop card to serve as standby in case of burn out or malfunctioning of any operating loop cards.
- xv. The panel shall be totally enclosed, dust and vermin proof.

4.3 Type of control and indicating panels:

Following are the types of control and indication panels in Addressable Fire Alarm Control Panel:

- (i) Intelligent Addressable Main Fire Alarm Control and Indicating Panel.
- (ii) Graphical Fire Alarm Management System.
- (iii) Intelligent Repeater Panel.
- (iv) Intelligent Response Indicator
- (v) Talk Back System / Fire Fighter Telephone Systems.

4.4 Addressable Fire Alarm Control Panel (FACP)

1. The addressable Fire Alarm Control Panel (FACP) shall function as a network panel & also as a fully stand alone panel. FACP shall have its own microprocessor, software and memory. In the event of failure of panel or communication breakdown between the networked panels the FACP shall automatically operate on stand-alone mode without sacrificing any functions (The networking should be peer to peer). Information of all panel in the network should be available on all individual panels.
2. The panel should be modular microprocessor based in nature and should be expandable from single loop up to 10 loops.
3. FACP shall supervise detection circuits and shall generate an alarm in case of abnormal conditions.
4. FACP shall provide general purpose inputs for monitoring such functions as low battery on AC power failure. FACP shall provide tamper protection and commandable outputs, which can operate relays or logic level devices.
5. Smoke detectors shall be powered using the FACP based smoke detection circuits FACP shall provide control for resetting smoke detectors, fault isolation and sensor loop operations. It shall be possible to mix different fire devices within same FACP to optimize field wiring.
6. It shall be possible for the panel to have a loop length with different modules offering 1.5 km length of devices from the panel.
7. FACP shall provide monitoring and control of one floor or area or for multiple floors or areas. FACP shall meet the following requirements to assure the integrity and reliability of the system:
 - (a) The FACP shall have proper listing and / or approval from the following recognized agencies:
 - (I) National Fire Protection Association (NFPA) -USA. This will cover the following approval:
 - (i) UL (Under writers Laboratories Inc.)

- (ii) ULC (Under writers Laboratories Canada)
- (iii) FM (Factory Mutual)
- (iv) CSFM (California State Fire Marshal)
- (II) EN (European)

This will cover the following approval:

- (i) LPCB (Loss Prevention Council Board)
- (ii) VDS (Vertauen Durch Sicherheit)
- (iii) BRE

FACP shall be NFPA/EN listed independently and as per relevant IS Code as a Fire Alarm Control Panel.

- (b) The FACP should have integrated power distribution module and fixed cabling done internally to guarantee a clear and tidy cable feed
 - (c) The panel should have an LCD display with minimum 300 characters and keypad. The Display should enable a flexible design of the operating menu with variable keys and message windows fixed keys should be used for standard operating steps e.g. for fire alarm securities supervisory trouble and other events. The current status of the system should be displayed by LED's interfaces (RS232) enable the connection to a PC.
 - (d) The panel should have a 230V AC power supply unit in plug in design with rack and panel connector and 24VDC /6Amp. single output power supply. The module should be protected against over voltage and reverse polarity. The output voltage is monitored and regulated externally.
 - (e) LCD display at the FACP shall be provided to indicate point of alarm or trouble. In Such systems means for manually scanning the points in trouble shall be provided and a trouble and alarm LED shall be used to indicate that there are points in alarm / trouble. The alarm /trouble LED shall only get switched off when all alarm / trouble are cleared from the loop.
 - (f) It shall be possible to command test, reset and alarm silence from the FACP.
8. FACP switches shall allow authorized personnel to accomplish the following, independent of the central console.
- (a) Acknowledge a general alarm condition.
 - (b) Silence the local audible alarm.
 - (c) It shall be possible to silence the alarm indicating devices (hooters).
 - (d) Reset all zones (logical Point Group) / points, after all initiating devices have returned to normal.
 - (e) Perform a complete operational test of the memory with a visual indication.

- (f) Test all panel LED's for proper operation without causing a change in the condition of any zone (Logical Point Group).
 - (g) Walk test –The system shall provide both a basic and advanced walk test for testing the entire fire alarm system including testing of all devices, detectors module etc. in the complete system.
9. Software zones/loops shall be circuited and protected by fault isolators such that in the event of a zone/loop short –circuit, smoke and thermal sensors shall be located and shall report alarm and fault isolator unit after every 20 detector or devices in a loop isolates the part.
 10. Monitoring modules shall be provided to monitor and address contact-type input devices. The monitor module shall be housed in the FACP supervised by FACP.
 11. The FACP shall have drift compensation facility to compensate for environment. When a detector accumulates dust in the chamber and reaches an unacceptable level but 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.
 12. The FACP should be NFPA/EN listed approved to provide the sensitivity measurement and documentation required.
 13. FACP shall be backed up with its built in UPS power or can be powered separately.
 14. The display on FACP shall provide indication for AC power, system alarm, system trouble/security alarm, display trouble and signal silence to this would mean that in the event of change of any detector/zone sequence alterations, the operator can initiate these by use of the LCD & alpha –numeric keys on the FACP panel to reconfigure the above parameters.
 15. Power supply unit of FACP shall have following characters:
 - (a) The main power supply shall be 230V AC $\pm 10\%$ 50Hz $\pm 3\%$ and shall in turn provide all necessary power of FACP.
 - (b) It shall provide a separate battery control module with charger. The battery should last for 24 hours minimum in normal operation upon power failure & 30 minutes in alarm condition.
 - (c) For ease of service, all wiring terminal blocks shall be plug-in type.
 - (d) The fire alarm panels shall have a possibility of being interlinked by direct connectivity or an optical cable link between the various locations and should further have connectivity to the main control center.
 16. Each loop shall have minimum 99 detectors/devices.
 17. There shall be minimum 20% spare capacity in the looping system for future expansions. The firm has to intimate the maximum number of devices/ detectors

can be connected in one loop based on the manufacturer design . Some devices need external supply and some devices supported by loop power.

18. The length of loop shall not exceed more than 3000 meter for wire size 1.5sq mm. as per manufacturer recommendations.
19. Each loop should not be divided into more than 8 fire zones.

4.5 Graphical Fire alarm management system

- (i) The fire alarm management system shall be a multiuser graphical management system to centrally monitor and operate the fire alarm system by a computer having a graphical software.
- (ii) All the messages and status of the connected detectors & devices with main control panel shall be displayed on the PC monitor to operate via keyboard and mouse. All devices & detectors should be visible on building plans superimposed in fire alarm system.
- (iii) The modular expansion of the system should be possible by adding software modules.
- (iv) Power graphics with a dynamic zoom function should be available.
- (v) The system shall have password system with individual password and access privileges shall also be available.
- (vi) The system should be capable monitoring status of detector. The status of each detector be monitored by the fire alarm system.
- (vii) The operator should be able to adjust the sensitivity of any detector.
- (viii) The operator should be able to define the entire database for the fire system.
- (ix) The operator should be able to acknowledge alarm or trouble messages by the fire alarm system.

4.6 Intelligent Repeater Panel

- (i) The repeater panel shall be active repeater panel with all the controls and monitoring as on the main fire alarm panel.
- (ii) The panel shall be functioning as a controller.
- (iii) The panel shall allow remote command in the system reset, trouble and alarm silence and manual alarm.
- (iv) A keyed switch shall enable or disable the keys.
- (v) The panel shall be compatible with the analog fire detection and alarm main control panel.
- (vi) It shall be programmable to display information for the entire system i.e. all panels in the network.

- (vii) It shall have minimum 80 characters LCD display (display system status). The back lit display repeats the status, trouble and alarm messages displayed at the fire detection and alarm panel in English text.
- (viii) The system text displays shall include: Alarm missing point trouble; system test, service, local system test, extra custom test by polling circuit and address.
- (ix) It shall have an internal trouble buzzer .
- (x) It shall be possible to connect upto 4 repeater panels with each fire detection & alarm panel.
- (xi) It shall annunciate alarm and trouble conditions.

Application:

The repeater panel can be installed in the guard rooms/security room at the entrance of a building or complex which may have one or more buildings so that in case of emergency the security personnel can rush straight to the trouble point.

4.6.1 Installation requirement of repeater panel:

- (i) No panel or management system shall be located inside any room the building or in a room of severe environment conditions.
- (ii) The panel shall be positioned in “Fire Alarm Control Room” in a building or any other conspicuously sited location so as to be visible without effort on entering a building and as per the drawing approval by the department /consultant architect.
- (iii) The panel shall be either wall mounted or floor mounted.

4.7 Response indicator:

- (i) The response indicator shall be used to locate a fire alarm if the detector's LED cannot be seen (i.e. it is hidden by false floors, false ceilings etc.). When a detector is set off, as well as the alarm message being sent, unit response indicator is also activated and flashes red.
- (ii) The response indicator shall loop powered and separate power supply shall not be required.
- (iii) Remote response indicator shall be installed outside the areas normally kept closed to identify the detector response even if the room is locked. These indicators shall be able to indicate the status of the corresponding detectors in these areas.

4.7.1 Installation of Response Indicator:-

- (i) Response indicator shall be installed on wall such that its top is at door level and by the side of the entrance to the respective premises.
- (ii) Response indicators for detectors installed over a false ceiling in a corridor shall be installed directly under the false ceiling.

- (iii) Response indicators for detectors under a false floor shall be installed at a height of 1 mtr. above false floor level. Additionally, a marking of an arrow pointing downwards shall be made by the side of the response indicator.
- (iv) The installation shall be such that visual indications from the response indicators are conspicuous and the affected area is spotted without difficulty.

4.8 Talk Back System/Fire Fighters Telephone Systems:-

(i) Fire Fighters Telephone System Panel:-

Fire Fighters Telephone System Panel shall be microprocessor based with its own microcontroller, memory, communication modules, intelligent initiating and indicating devices and suitable SMPS. The panel shall be suitable for required number talk back unit connections. The fire fighters telephone system will have integral talk back system to provide a 2 way voice communication between the fire fighters telephone. The talk back system shall include fire fighter master control console with a backlit LCD display for status display and a fire fighters telephone handset, standby battery for 24 hours in operation and half an hour alarm condition. The Fire Fighter Telephone System shall also include the following:

A red colored master telephone handset with flexible coiled self winding five feet cord placed within the fire fighters telephone system panel housing:-

The Fire Fighters Telephone Systems Panel shall include:-

- Indicating High power LEDs
- Input power supply : 230 volts AC 50Hz single phase supply 17-28V DC through rectifier, sealed maintenance free battery including trickle/Booster battery charger. Fire fighters telephone system panel housing shall be Dust and vermin proof cold rolled steel sheet 16 gauge powder coated with see through glass front Fire fighters Telephone system shall be able to withstand 10⁰ to 490⁰C and upto 93 % RH non condensing type.

Fire fighter Telephone system shall be able to be integrated with building and control system and Public Address System.

(ii) Talk back Units/Fire Fighters Telephone:-

Red Colored fire fighters telephone of rugged ABS plastic construction with 1500 mm coiled cord, a hook switch and the telephone jack placed in a surface mounted cabinet of 18 gauge CRC sheet steel construction with a hinged lockable door and a break glass full front panel labeled. Fire Fighters Telephone including painting with two coats of red synthetic enamel paint over one coat of primer.

SECTION-5

ADDRESSABLE INTELLIGENT SOUNDERS AND SILENCING SWITCHES

5.1 SCOPE

This section covers the requirements of sounders and silencing switches used in fire alarm systems:

5.2 Type of Sounders:

- (i) Panel Sounders
- (ii) Addressable Loop Fire Alarm Sounders.

5.3 Functional requirements:

- (i) Panel Sounder shall be provided in specified fire alarm panel, repeater panel if any so as to draw attention of the caretaking personnel in a building to a fault in the FAS wiring and a fire condition in the protected premises.
- (ii) Fire alarm sounder of low intensity type shall be installed to signal to the occupants of the building to evacuate in the event of a fire.
- (iii) Fire alarm sounders cum strobe of high intensity types shall be installed to draw the attention of the fire fighting personnel towards the main location of fire in the premises where a fire has erupted. The strobe should have a light intensity of 15cd. To 100cd.
- (iv) Fire alarm sounders shall not be used for any purpose other than for fire operations.
- (v) Silencing facility shall be provided only for panel sounders and not for fire alarm sounders.
- (vi) It shall be designed Suitable for ceiling mounted or wall mounted.

5.4 Operation of sounders and silencing:

- (i) Panel sounders shall be actuated automatically from the control panel.
- (ii) Panel sounders shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device connected to them. These shall also be sounded when there is a fault alarm signal within their areas of control.
- (iii) A silencing switch shall be provided in the panel. Operation of this switch shall mute the audio output from the panel sounder in this panel and in its repeater panel, if any. Silencing switch shall also be provided in repeater panel which when actuated shall mute the audio output in the panel only.
- (iv) Fire alarm sounders in a zone affected by a fire shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device in that zone. All other fire alarm sounders shall be actuated only automatically from the fire alarm panel.

5.5 Specification Requirements:

5.5.1 Sounders

- (i) The frequency of sound from sounders shall lie in the 500-1000 Hz band. The sound level shall be at least 65dB (A) or 5dB (a) above or any other noise likely persists for a period longer than 30 second at any part of the building sounders with a level greater than 120 dB (A) shall not be provided.
- (ii) The sound shall be continuous although the frequencies and amplitude may vary and of the same characteristics from the fire alarm sounders in a building. Coded fire alarm signaling from sounders shall not be provided which may cause hearing damage.
- (iii) 'Fault alarm' and 'Fire alarm' in a panel sounder shall be distinctly different.
- (iv) The sounder shall be with IP 54 protection category.
- (v) It shall conform to EN/NFPA/Indian standards.
- (vi) The volume of sounders can be adjusted from the fire detectors control panel. Minimum three volume setting from fire alarm control panel shall be available.
- (vii) The strobe cum hooter are two wire devices that offer tone choices of either continuous horn or temporal tone when constant voltage from fire alarm control panel is applied. Each tone has minimum three volume levels that can be selected for installation.
- (viii) The strobe cum hooter installed at entrance of building should have three tones programmable from the fire detector control panel so that at least one of these tones can be selected to comply with at least 110dB (A) frequency range of 440Hz to 2850 Hz. The Volume should be adjustable from control panel.
- (ix) The strobe should have a light intensity from 15 cd to 110 cd.

5.6 Installation Requirements:

- (a) Low intensity fire alarm sounders may be installed on surface of ceilings, suspended from ceiling or recessed in flush with the ceiling, depending on the construction of the sounder and ceiling height.
- (b) These shall be installed at a height not lower than 2.4 mtrs. except when recessed in a false ceiling of lower height. In such cases the sounders shall be recessed at false ceiling level.
- (c) When installed flush with a false ceiling these shall match the ceiling surface. Necessary provisions such as wooden boxing or frame work to accommodate the sounders shall be made in the ceiling in advance.
- (d) High intensity sounders shall be mounted on substantial supports. Provisions for terminating the electrical wiring cables shall be such as not to permit entry of rain water through the wiring conduits or cable runs.

SECTION-6

MIMIC PANEL

6.1 SCOPE :

This Section covers the requirements of mimic panel to be provided as part of a Fire Alarm Systems for remote display.

6.2 MIMIC Panel

- (i) A clear indication of the locations of all the ZONES shall be provided in mimic panel.
- (ii) It shall be provided at a remote location wheresoever's required.
- (iii) A topographical representation of the premises shall be provided in the mimic diagram for the purpose.
- (iv) The construction shall either in a metal frame work or plastic housing or as per manufacturer design suitable for wall mounting.
- (v) The panel shall have alarm LED's display in red, yellow or a combination.
- (vi) One set of LED's represent one Zone.
- (vii) The mimic panel (Remote Display) shows the display of malfunctions and/ or alarm for detector or detector zone.
- (viii) It shall have Built-in-isolator to maintain complete functions of all elements in loop if wires are broken or if there is a short circuit.
- (ix) It shall monitor data communication between control panel/panels.

Locations: In Guard room/ Security rooms of the campus /Main Gates / Entrance Gates.

SECTION-7

POWER SUPPLY EQUIPMENT AND WIRING

7.0 SCOPE:

This section covers the requirements of power supply equipment for the addressable Fire Alarm System (AFAS) and the wiring for the system.

7.1 Main Supply

Power supply at $230 \pm 10\%$ V, 50Hz, AC single phase shall be provided by the department, terminating directly into the incoming switches of the C&I panel. Earth wire shall also be provided with the power supply. Rectification of the input AC supply into DC and further stabilization of the voltage as may be necessary shall form part of the FAS equipment.

7.2 Stand by battery supply

7.2.1 Standby battery shall be provided with Fire Alarm Control Panel.

7.2.2 Battery supply shall be arranged to automatically feed the FAS in the event of variation of input A.C. voltage beyond preset values on high and low sides.

7.2.3 The battery shall be sealed completely maintenance free. The battery shall be conforming to relevant Indian/International Standard. The normal voltage shall be suitable for the AFAS. The Capacity of the battery shall be suitable to feed the fire alarm panel and other addressable loop elements for a period of 24 hours upon a normal power failure and after which sufficient battery shall remain to provide full load operation for at least 30 minutes in line with IS 2189.

7.2.4 Installation:

Battery shall be located in the main fire alarm panel.

7.3 Battery Charger

7.3.1 The power supply in the fire alarm panel shall be in-built automatic battery charger suitable to charge the batteries as per the requirements of relevant standard.

7.3.2 The charger shall be complete with necessary voltmeter, ammeter, indicating lamps, fuses etc.

7.3.3 It shall have protection from overloads and short circuits on both AC & DC sides.

7.3.4 It shall have protection to prevent discharge through the charger.

7.4 Wiring for FAS/AFAS

7.4.1 Circuit Design:

(i) The loop element (Smoke Detectors Heat Detectors, Manual Call Points, Monitor Modules Control Modules, Loop Sounders) wiring in AFAS shall be closed circuit

loop type (Class A type) , so that if the communication fails from one side, it is restored automatically from the other side. The wiring shall be independent of the detector zoning. The Zones shall be software based.

- (ii) The design of the system wiring shall match the control and indicating equipment in the system.

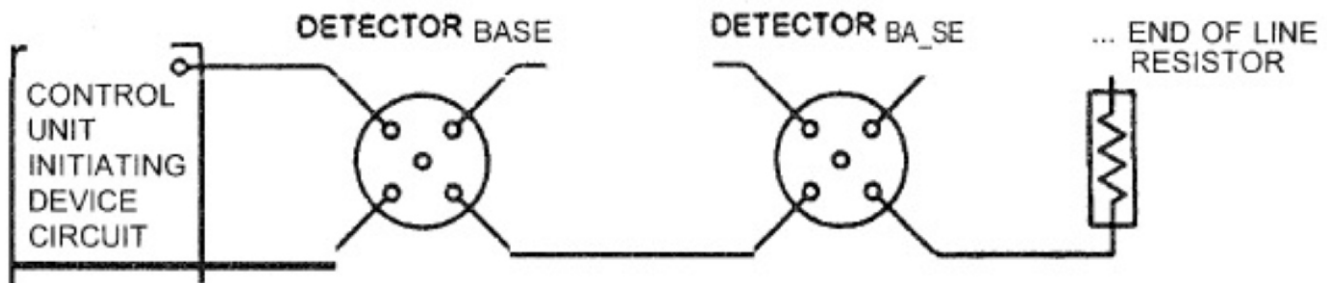
7.4.2 Wiring Materials:

- (i) The wiring shall be PVC insulated 2 core 1.5 Sq mm FRLS shielded copper Conductor stranded cables in red/black color and generally confirming to IS-694-2010 and meet the signal cabling requirements.
- (ii) The strand of cables shall not be cut to accommodate & connect to the terminals. The terminals shall have sufficient cross sectional area to take all the strands.

7.4.3 Installation requirements:

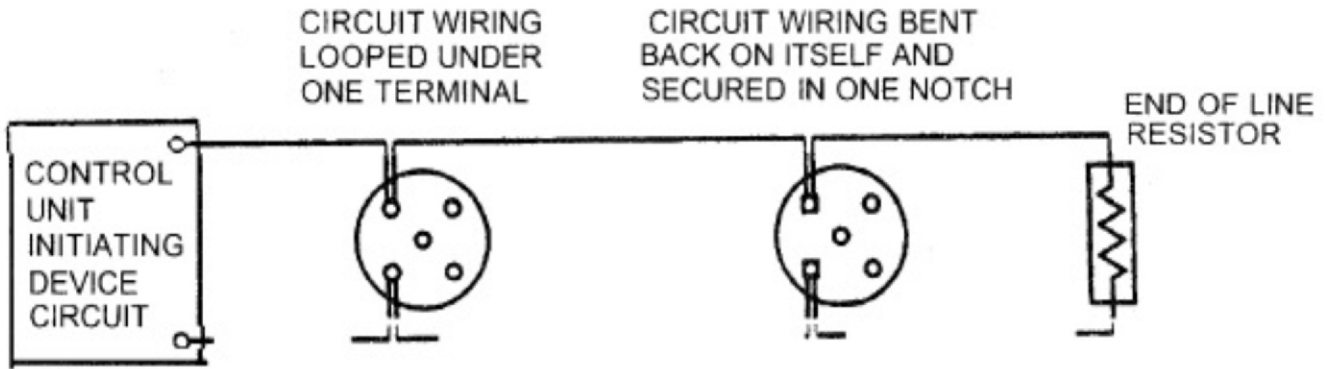
- (i) The electrical work connected with a FAS shall be carried out in conformity with CPWD general specification for electrical works Part-I (Internal) 2013, and part-II (external) 1994, both amended up to date.
- (ii) In no case the FAS equipment or connections be mounted in or on boxes, cover plates or blanks carrying the accessories or connections of any other service.
- (iii) FAS wiring shall be exclusive to the FAS and be physically separated from wiring for any other service in the building.
- (iv) Wiring for different circuit voltages in a FAS shall be in separate conduits.
- (v) To minimize possible disruption due to fire or other causes, fire alarm circuits should be separated as much as possible from each other . Where practicable, the different fire alarm circuit shall be run through different routes.
- (vi) The metal body of all control and indicating panels shall be loop earthed using 2.5 sqmm copper wire and bonded to the earthling system in the building.

CONVENTIONAL (NON - ADDRESSABLE)
DETECTION SYSTEM - CLASS B WIRING

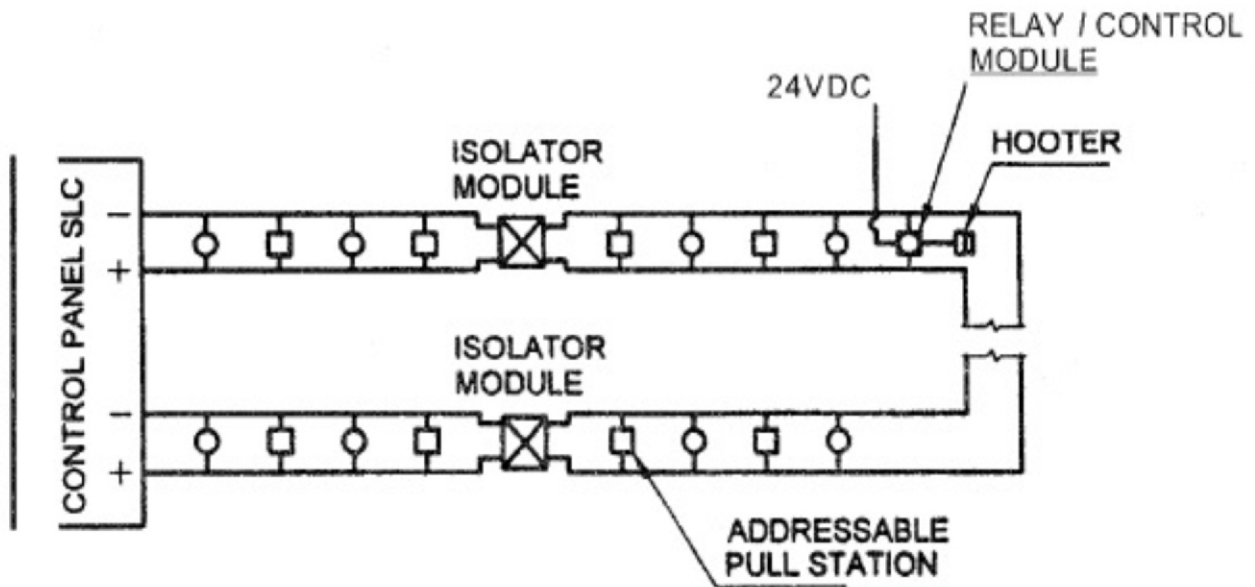


1A Correct Wiring Method - Two-Wire Detectors

CONVENTIONAL (NON - ADDRESSABLE)
DETECTION SYSTEM - CLASS B WIRING



1B Incorrect Wiring Method - Two-Wire Detectors



* LOOP POWERED HOOTER / SOUNDER
OR
*SEPARATE POWERED HOOTER

1C Addressable Fire Detection and Alarm System - Class A Wiring

Specimen

DRAFT

N.I.T.

Note:- THE SPECIMEN DRAFT NIT CONTAINS ONLY SUGGESTIVE CONDITIONS. THE NIT APPROVING AUTHORITY MAY MODIFY THE SPECIMEN NIT TO SUIT THE REQUIREMENT AND SITE CONDITIONS.

PRESS NOTIFICATION

**To be Attached by NIT Approving Authority
As per CPWD Works Manual**

COMMERCIAL AND ADDITIONAL CONDITIONS

1.0 General

- 1.1 This specification covers manufacturing, testing as may be necessary before dispatch, delivery at site, all preparatory work assembly and installation, commissioning putting into operation of FAS/AFAS including intelligent addressable fire alarm system & final testing & commissioning.
- 1.2 Location: The equipments will be installed at.....
The work shall be executed as per CPWD General Specifications for Electrical Works Part-I (Int.) 2013, Part-II (Ext.) 1994, Part-IV (Sub St.) 2013, Part-VI (FAS)-2018, as amended upto date, relevant I.E. Rules, BIS/IEC and as per directions of Engineer-in-Charge. These additional specifications/conditions are to be read in conjunction with above and in case of variations; specifications given in these additional conditions shall apply. However, nothing extra shall be paid on account of these additional specification and conditions, as the same are to be read along with schedule of quantities for the work.
- 1.3 The tenderer should in his own interest visit the site and get familiarize with the site conditions before tendering.
- 1.4 No T&P shall be issued by the Department and nothing extra shall be paid on account of this.

2.0 Commercial Conditions:

2.1 Type of contract: The work to be awarded by this tender shall be treated as indivisible works contract.

2.2 Submission and opening of Tenders:

The tender is in two parts:

(a) Part-I -Technical cum Unpriced commercial Bid

(b) Part-II-Price Bid

2.2.1 The tender shall be submitted online, duly completed as per NIT conditions within period of bid submission:

2.2.2 The tenderers are advised not to deviate from the technical specifications/item, commercial terms and conditions of NIT like terms of payment, guarantee, arbitration clause, escalation etc.

2.2.3 Technical cum unpriced commercial bid only shall be opened on the due date and time in the presence of tenderers or their authorized representative who wish to remain present.

2.2.4 Scrutiny/evaluation of the technical-cum-commercial bid shall be done by the department. In case, it is found that the technical-cum-commercial bid of a tenderer is not in line with NIT specifications/requirements and/or contains too many deviations, the department reserves the right to reject the technical bid of such firms(s) without making any reference to the tenderer(s).

2.2.5 Necessary clarifications required by the department shall have to be furnished by the tenderer within the time given by the department for the same. The tenderer will have to depute his representative to discuss with the officer(s) of the department as and when so desired. In case, in the opinion of the department a tenderer is taking undue long time in furnishing the desired clarifications, his bid will be rejected without making any reference.

2.2.6 After obtaining clarification from all the tenders, the department will intimate the tenders whose technical cum commercial bids are acceptable.

2.2.7 The price bids of only those tenderers shall be opened whose technical bids are found to be technically acceptable. The time and date of opening of price bid shall be fixed after the technical cum unpriced commercial bid is accepted and intimated to them by post/Fax/e-mail.

2.2.8 The department reserves the right to reject any or all the price bids and call for fresh prices/tenders as the case may be without assigning any reason.

3.0 Terms of Payments

The following percentage of contact rates for the various items included in the contact shall be payable against the stage of work shown herein.

- 3.1 80% after initial inspection and delivery at site in good condition on pro-rata basis.
- 3.2 10% after completion of installation in all respects.
- 3.3 Balance 10% will be paid after testing, commissioning and handing over to the department for beneficial use.

3.4 Security Deposit

Security Deposit shall be deducted from each running bill and final bill to the extent of 2.5% of the gross amount payable. The security deposit shall be released on the expiry of guarantee period stipulated in the contract.

3.5 Performance Guarantee

The successful tenderer shall submit an irrevocable performance guarantee of 5% of the tendered amount in addition to other deposit mentioned elsewhere in the contract for his proper performance of the contract agreement within 15 days of issue of letter of acceptance of tender. This guarantee shall be in the form of Demand Draft/Pay order of irrevocable bank guarantee bond of any schedule bank or the State Bank of India in the specified perform a of Government Security, fixed deposit receipt pledged in favour of Executive Engineer or as specified in the letter of acceptance of tender. The performance guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond. This bank guarantee shall be kept valid till the recording of completion certificate for the work by the competent authority.

- 3.6 Income tax, GST, labour cess & other statutory deduction etc. shall be made at source as per the prevalent laws. The deduction of Security Deposit, Income Tax, etc., shall be done after calculation for the above due payment as per clauses 3.1 to 3.3 and net payment shall reduce accordingly.

4.0 Rates

- 4.1 The rates quoted by the tenderer, shall be firm and inclusive of all taxes (including works GST & labour cess), duties, levies, etc. and all charges for packing forwarding, insurance, freight and delivery, installation, testing and commissioning etc. at site including temporary construction of storage, risks over head charges, general liabilities./ obligations and clearance from CFO. However, the fee if any, for the CDO inspections shall be borne by the Department.
- 4.2 The contractor has to carry out maintenance as per manufacturer's standards for a period of 12 months from the date of handing over. Nothing extra shall be paid on this account.

5.0 Completeness of tender

All sundry equipments, fitting, unit assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work

shall be deemed to have been included in the tender irrespective of the fact whether such items are specially mentioned in the tender documents or not.

6.0 Storage and Custody of Material

The agency has to make his own arrangement for storage. No separate storage accommodation shall be provided by the department Watch and ward of the storage and their safe custody shall be responsibility till the final taking over of the installation by the department.

7.0 Care of the Building

Care shall be taken by the contractor while handling and installing the various equipment and components of the work to avoid damage to the building. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost. He shall also remove at his cost all unwanted and waste material arising out of the installation from the site of work.

8.0 Completeness Period

The completion period indicated in the tender documents is for the entire work of planning, designing, approval of drawings etc, arrangement of materials & equipments, delivery at site including transportation, installation, testing, commissioning and handing over of the entire system to the satisfaction of the Engineer-in-charge.

9.0 Guarantee

9.1 All equipments shall be guaranteed for a period of 12 months from the date of taking over the installation by the department against unsatisfactory performance and/ or breakdown due to defective design, workmanship or material. The equipment or component, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor. The decision of Engineer-in-Charge in this regard shall be final & binding on the contractor.

9.2 The tenderer shall guarantee among other things, the following:

- (a) Quality, strength and performance of the material used as per manufacturer's standards.
- (b) Safe mechanical and electrical stress on all part under all specified conditions of operation.
- (c) Satisfactory operation during the maintenance period.

10.0 Water supply / Power Supply

Water & power supply shall be made available by the department at one point in campus free of cost. Further, the arrangement for tapping power / water supply from this point shall be made by the contractor.

11.0 Acceptable makes of various equipments

The acceptable makes of various equipments / components / accessories have been indicated in "Acceptable Makes" indicated in the list attached. The tenderer shall work out the cost of the offer on this basis. Alternate makes are not acceptable.

12.0 Data Manual and Drawing to be furnished by the tenderer:

12.1 With tender : The tenderer shall furnish alongwith the tender, detailed technical literature, pamphlets and performance data for appraisal and evaluation of the offer.

12.2 After award of work: The successful tenderer be required to submit the following drawings within 15 days of award of work of approval before commencement of installation.

(a) General arrangement drawing of the equipments like Detectors, R.I., C&I Panel etc. in the building with complete dimensions.

(b) Any other drawing necessary for the job.

13.0 The successful tender should furnish well in advance three copies of detailed instruction and manuals of manufacturer's for all items of equipments regarding installation , adjustment operation and maintenance including preventative maintenance and troubleshooting together with all the relevant data sheets, spare parts catalogue etc. all in triplicate.

14.0 Extent of Work

14.1 The work shall comprises of entire labour including supervision and all material necessary to make a complete installation and such tests and adjustment and commissioning as may be required by the department. The term complete installation shall not only mean major items of the plant and equipments covered by the specification but all incidental sundry components necessary for complete execution and satisfactory performance of installation with all layout charts whether or not those have been mentioned in details in the tender documents in connection with this contract as this is a turnkey job.

14.2 In addition to supply, installation, testing and commissioning of FAS/ AFAS including intelligent addressable FAS equipments, following works shall be deemed to be included with the scope of work to be executed by the tenderer as this is a turnkey job-

(a) Minor building works necessary for installation of equipments, foundation making of opening in walls or in floors and restoring them to their original condition / finish and necessary grouting etc. as required.

(b) All supports for cable and MS Channel for erection as are necessary.

(c) Getting CFO inspection done and obtaining clearance. However, necessary fees for inspection shall be borne by the Department.

15.0 Exclusion and work to be done by other agencies:

The following shall be excluded from the scope of work:

- (a) Major dismantling of any existing building work.

16.0 Inspection and Testing

16.1 The material and equipments shall be offered for initial inspection at manufacturer's works. The contactor will intimate the date of testing of equipments at the manufacturer's work before dispatch. The successful tenderer shall give advance notice of minimum two weeks regarding the dates proposed for such test to the department representative to facilitate his presence during testing. The Engineer-in-charge may witness such testing. The cost of the Engineer visit to the factory will be borne by the Department. Equipments will be inspected at the manufacturer/ Authorized Dealers premises before dispatch to the site by the contractor. Nothing extra shall be paid for initial inspection/testing at Manufacture Works.

16.2 Copies of all documents of routine and type test certificates of the equipment carried out at the manufactures premises shall be furnished to the Engineer-in-charge and consignee.

17.0 VALIDITY

Tenders shall be valid for acceptance for a period of _____ days from the date of opening.

18.0 COMPLIANCE WITH REGULATIONS AND INDIAN STANDARDS:

18.1 All works shall be carried out in accordance with relevant regulation both statutory and those specified by the Indian Standards related to the works covered by this specification in particular, the equipment and installation will comply with the following:

- (i) Factories Act.
- (ii) Indian Electricity Rules
- (iii) B.I.S. & other standards as applicable
- (iv) Workmen's compensation Act.
- (v) Statutory norms prescribed by local bodies like fire department, CEA, Power Supply Co. etc.

18.2 After completion of the installation the same shall be offered for inspection by the representatives of the C.F.O. The contractor will extend all help including test facilities to the representatives of CFO. The observation of CFO will be attended by the contractor.

18.3 Nothing in this specification shall be constructed to relieve the successful tender of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes.

18.4 Successful tenderer shall arrange for compliance with statutory provisions of safety regulations and departmental requirements of safety codes in respect of labour employed on the work by the tenderer. Failure to provide such safety requirements would make the tenderer liable for penalty of Rs.-----/- for each default. In addition, the department will be at liberty to make arrangement for safety requirements at the cost of tenderer and recover the cost thereof from him.

19.0 INDEMNITY

The successful tenderer shall at all times indemnify the department, consequent on this works contract. The successful tenderer shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause and the contractor shall be responsible for any accident or damage incurred or claims arising there from during the period of erection, construction and putting into operation the equipments and ancillary equipment under the supervision of the successful tenderer in so far as the latter is responsible. The successful tenderer shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the successful tenderer on account of the above.

20.0 Erection Tools :

No tools and tackles either for unloading or for shifting the equipments for erection purposes would be made available by the department. The successful tendere shall make his arrangement for all these facilities

21.0 Cooperation with Other Agencies:

The successful tenderer shall co-ordinate with other contactors and agencies engages in the construction of building if any, and exchange freely all technical information so as to make the execution of this work / contract smooth. No remuneration should be claimed from the department for such technical cooperation. If any unreasonable hindrance is caused to other agencies and any completed portion of the work has to be dismantles and re-done for want or cooperation and coordination by the tenderer during the course of work, such expenditure incurred will be recovered from the successful tenderer if the restoration work to the original condition or specification of the dismantled portion of work was not under taken by the tenderer himself.

22.0 Mobilization Advance:

No mobilization advance shall be paid for this work

23.0 Insurance and Storage:

All consignments are to be duly insured upto the destination from warehouse at the cost of the contractor. The insurance covers shall be valid till the equipment is handed over duly installed, tested and commissioned.

24.0 Verification of Correctness of equipments at destination:

The contractor shall have to produce all the relevant records to certify that the genuine equipments from the manufacturers has been supplied and erected.

25.0 Painting

This shall include cost of painting of the entire installation. The major equipments like C&I Panel, cable trays etc. shall be factory final finish painted. The agency shall be required to do only touching to the damages caused to the painting during transportation, handling & installation at site, if there is no major damage to the painting. However hangers, supports etc. of cable tray etc. shall be painted with required shade including painting with two coats of anti corrosive primer paint at site.

26.0 Training :

The scope of work includes the on job technical training of two persons of department at site. Nothing extra shall be payable on this account.

27.0 Maintenance:

27.1 Sufficient trained and experienced staff shall be made available to meet any exigency of work during the guarantee period of one year from the handing over of the installation.

27.2 The maintenance, routine as well as preventative for one year from the date of taking over the installation as per manufactures recommendation shall be carried out.

28.0 Interpreting Specification:

In interpreting the specification, the following order of decreasing importance shall be followed in case of contradictions:

- (a) Schedule of quantities
- (b) Technical Specification
- (c) Drawing (if any)
- (d) General Specification
- (e) Relevant BIS or other international code in case BIS code is not available.

29.0 Pre-Bid Conference

It is proposed to hold a pre-bid conference with the prospective tenderers to enable them to seek clarification on the technical specification and in tender documents that they may consider necessary for submission of tender (technical bid & price bid). All clarification sought for will be finalized during the pre-bid conference and confirmatory minutes for the pre-bid conference will be circulated among all tenderes who have been issued the tender documents irrespective of the fact they have attended the pre bid conference or not. The date and time of pre-bid conference will be informed to the tenderer at the time of issue of tenders. It is upto the prospective tenderers to take part in the pre-bid conference. Non attendance of pre-bid conference does not debar the prospective tenderes form participating and submission of tender. No separate pre-bid conference will be conducted for the firms who do not attend the pre bid conference on the date and time fixed for the purpose.

Appendix-I
SCHEDULE 'A'
SCHEDULE OF TECHNICAL PARTICULARS

S. No.	Particulars	Guaranteed data
1.	2.	3.
A.	Manual Call Box	
1.	Make	
2.	Material	
3.	Thickness of body	
4.	Material of frangible element	
5.	Overall dimensions	
B.	Detector (Give for each type of detector separately)	
1.	Make	
2.	Type	
3.	Specification conforming to	
4.	Any special features	
C.	Control and Indicating panels (Give separately for each type of panel)	
1.	Make	
2.	Type	
3.	(i) Overall dimensions (ii) Sheet metal thickness	
4.	A.C voltage at input	
5.	D.C voltage for system operation	
6.	Any special features	
D.	Mimic diagram	
1.	Overall dimensions	
2.	Thickness for sheet metal	
3.	Material of the top sheet	
4.	Type of indicator lamps	
5.	Any special features	

E. Battery Unit

1. Make
2. Type
3. Voltage
4. AH Capacity

F. Sounders

1. Make
2. Type

G. Exit Sign

1. Make
2. Type

H. Fire Fighter Telephone System

1. Make
2. Type
3. Confirmation Standard

Signature of Tenderer

Appendix-I
SCHEDULE 'B'

SCHEDULE OF ADDRESSES OF MANUFACTURERS

S. No.	Item	Manufacturer's name	Place Where Can Be offered for test/inspection	Name & Address Of The person who should be contacted
1	2	3	4	5
1.	Trigger devices			
2.	Control and indicator panel			
3.	Mimic diagram			
4.	Sounders			
	(a) High intensity			
	(b) Low intensity			
5.	Battery unit			
6.	Exit Signs			
7.	Telephone/Talk back System			

Signature of Tenderer

Appendix-I
SCHEDULE 'C'
SCHEDULE OF PROGRAMME OF WORK

S. No.	Details of Items	Months	1	2	3	4	5	6	7	8	9	10
(a)	Supply of drawings for approval.											
(b)	Bringing equipment/material to site											
	1. Trigger devices											
	2. Control and indicating panels											
	3. Mimic diagrams											
	4. High/low intensity sounders											
	5. Battery unit											
	6. Wiring materials											
	7. All other items											
(c)	Installation/testing and commissioning											

Signature of Tenderer

Appendix-I
SCHEDULE 'D'

SCHEDULE OF DEPARTURE FROM SPECIFICATIONS

Section	Ref. to Clause of the specifications	Description of departure	Reason of departure	Remarks
(1)				
(2)				
(3)				
(4)				

Certified that except for the departures mentioned above, the tender is in accordance with CPWD General Specifications for Electrical Works (Part VI Fire Alarm System 2018) and in accordance with detailed requirements specified in the tender specifications.

Signature of the tenderer

TERMINOLOGY

Scope

This appendix gives the definition of terms used in these specifications.

1. **Automatic Fire Alarm System (AFAS):**

The arrangement of fire detectors, sounders and other equipments for automatic transmission and indication of alarm signals without manual intervention. The system has also provision for testing of circuits and where required, for the operation of auxiliary services.

2. **Automatic Addressable System:**

The system in which signal from detectors, manual call points or any other devices are individually identified at the control & indicating Equipment.

3. **100% Redundancy:**

Two identical systems housed in one in the form for doubled/duplicated electronics.

4. **Activation Device (Trigger Device):**

A device capable of being operated automatically or manually to initiate an alarm of fire e.g. a detector, a manual call point or a pressure switch.

5. **Acknowledge:**

To confirm that a message or signal has been received such as by pressing of a button or the selecting of a software command.

6. **Addressable Device:**

A fire alarm component with discrete identification that can have its status individually identified or that is used individually to control other functions.

7. **Automatic fire detector:**

A trigger device to automatically detect an out break of fire such as a fuse operating at a given temperature, a thermostat or a fluid filled tube or an electronic device.

8. **Combination detector (or Multi-Sensor detector):**

A trigger device that either (a) responds to more than one of the fire phenomenon such as heat, smoke flame, fire –gas etc. or (b) employs more than one operating principle to sense one of these phenomenon e.g. a combination of heat detector and smoke detector or a combination of fixed temperature and rate of rise heat detectors.

9. **Beam Detector:**

Photoelectric light obscuration smoke detector where beam spans the protected area. Also known as linear smoke detector using a transmitted light beam.

- 10. Intelligent smoke detectors:**
Detectors with integral microprocessor and capable of evaluating the smoke characteristics.
- 11. Optical smoke detector:**
Detector working on light scattering principle that detects visible or invisible particles of combustion.
- 12. Manually operated electric fire alarms systems (MOEFAS):**
An arrangement of manual call boxes, fire alarm sounders and other equipment for transmission and indication of alarm signals, initiated by the breaking of the frangible element in the front face of the manual call box.
- 13. Manual call point (or alternatively, manual call box or pill box):**
Manual trigger device for initiating an alarm of fire provided in the fire alarm circuit.
- 14. Smoke :**
Particulate and aerosol products of combustion generated by fire, whether this be smoldering or open flame type, In general the particle diameters range from 10 micrometer (visible smoke) to 1 nanometer (invisible smoke).
- 15. Ambient temperature:**
For purpose of this specification, this term refers to the temperature of air inside a building around a fire detector.
- 16. Detection Zone:**
A Geographical sub-division, of the protected premises such that the occurrence of a fault /fire within it will be indicated at the C&I panel separately and independently, of a fault/fire in another sub division (zone).
- 17. Sector:**
A Geographical sub-division, of the protected premises larger than a zone. Two or more zones constitute a sector. This shall not extend beyond one floor including mezzanine floor if any.
- 18. Control and indicating panels:**
Panels which may monitor the system and provide either visual indication or audio and visual indication, of fault/fire condition. These comprise:
- (a) Main control and indicating panel (C&I Panel):
 - (b) Sector panel;
 - (c) Repeater panel; and
 - (d) Spot indicator
 - (e) Zonal Panel

- 19. Spot indicator:**
Visual indicator provided externally to the closed premises to indicate triggering of any of the detectors within.
- 20. Parallel Indicator:**
LED indicator for the detectors whose LED cannot be seen directly or triggering of any of the detectors within.
- 21. Sector panel:**
This is provided in each sector so as to provide visual indication of the affected zone. Audio indication should be provided additionally in this panel.
- 22. Zonal panel:**
This is provided in each zone to indicate the fault/fire condition in that zone. Zonal panel is not required to be provided, where sector panel is provided in any floor of a building. Audio indication should be provided additionally in this panel.
- 23. Main control and indicating panel (C&I Panel):**
This panel comprised control and indicating equipment for the reception, control, monitoring and relaying of signals originating from trigger devices in various zone/sectors connected to it and for the activation of fire alarm sounders and indication of the affected zones. This panel shall also have the P.A system equipment for the FAS/AFAS. This shall be provided in all FAS/AFAS installations including small ones with only one zone. Power supply to the entire FAS/AFAS shall be fed through this panel.
- 24. Repeater panel:**
A duplicate of C&I panel to indicate the alarm conditions including the audio output, and powered from the C&I panel.
- 25. Short Circuit Isolators:**
Devices which may be connected into a transmission of a fire detectors and fire alarm system/AFAS, to limit the consequences of low parallel resistance fault between the lines of this transmission flats.
- 26. Control Centre:**
Permanently staffed room within or near the premises where the C&I panel is installed and from where communication to Fire Brigade can be made.
- 27. Control Module:**
Module use to do actuations based on a set of instructions.
- 28. Monitor Module:**
Module used to monitor the potential free polling relay contacts and also the connection from the module to the contact being monitored for wire breaks and short circuit.

- 29. Fail programmable output:**
Output /Relay that can be programmed to function in three conditions viz. NORMAL, FIRE and NO-POWER.
- 30. False alarm:**
Fire alarm caused by reasons other than fire.
- 31. Fault:**
Failure within the system in such a way as to jeopardize the correct functioning of the system.
- 32. Fire alarm:**
Visual, audible or tactile indication of fire.
- 33. Fire signal:**
Signal intended to indicate the occurrence of a fire.
- 34. Fire Alarm Management System:**
Graphical representation of the elements on a floor plan using a PC directly connected to the alarm panel. The complete fire alarm system/AFAS can be centrally monitored and operated from here.
- 35. Hard addressing:**
Addressing of elements manually on the element itself by using any type of switch like Decade switch, Rotary switch, Binary Jumpers, DIP switches, etc.
- 36. Mimic diagram:**
A topographic representation of the protected premises and their Geographical subdivision, carrying indicating devices for each sub division, such that the indications of the fire alarm system/AFAS can be rapidly related to the layout of the premises.
- 37. Fire alarm sounders:**
Devices like gong bells or hooters, which give audio signals when actuated, in protected premises.
- 38. Panel sounders:**
Devices provided in the control and indicating panel(s) to sound in the event of operation of a trigger device or a fault in the system wiring.
- 39. Monitored wiring :**
Wiring in which an open circuit, short circuit or earth fault will result in a fault warning.
- 40. Spacing :**
A horizontally measured dimension relating to the allowable coverage of fire detectors.
- 41. Fire compartment:**

Portion of building separated by fire resisting walls and doors along the escape routes to prevent spread of fire and smoke.

42. Lantern light:

A construction standing above the surface of a roof and containing translucencies intended to admit light to the space below.

43. Audibility:

Property of a sound which allows it be heard among other sounds in the background.

44. Circuit:

Assembly of the fire alarm components supplied from the same control and protected against over current by the same protective devices(s) or current limitations arrangement.

45. Circulation Area:

Area (including a stairway) used mainly as a means of access between a room and an exit from the building or compartment.

46. Commissioning:

Process by which it is determined that the installed system meets the defined requirements.

47. Line detector:

Detector which responds to the Phenomenon sensed in the vicinity of a continuous line.

48. Stand by power Supply:

Power supply, commonly from a rechargeable battery, which is automatically connected to the fire alarm system when the normal supply fails.

49. Points detector:

Detector which responds to the phenomenon sensed in the vicinity of a fixed point.

APPENDIX-III

(ABSTRACT OF NBC-2016)

Table 23 Minimum Requirement for Fire fighting installation

(Clauses 4.18.2,6.1.2,6.2.3,6.3.2,6.4.3,6.5.2.1,6.5.2.2,6.5.2.3,6.5.2.4,6.5.2.5,6.6.2,6.7.2,6.8.2,6.8.2 and 6.9.2)

S.No	Type of Building Occupancy	Type of Installation										Water supply (In.l)		Pump Capacity (In-l/Min)		
		Fire Extinguisher	Hose Reel	Dry Riser (see Note-6)	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electric Fire Alarm System	Automatic Detection and Alarm System	Underground static water storage Tank	Terrace Tank	Pump near underground static water storage Tank (Fire Pump. With minimum Pressure of 3.5kg/cm2 at terrace Level	At the terrace Tank –Level with Minimum pressure of 2.0kg/cm2		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
	RESIDENTIAL BUILDINGS (A) a) Lodging or Rooming (A+1) House (see Note-1) 1) Less than 15m in height i) Up to 15 Room ii) More than 15 and upto 30 rooms	R	NR	NR	NR	NR	NR	R (see Note-2)	NR	NR	NR	5000 (see note-1)	NR	NR	NR	NR
		R	NR	NR	NR	NR	NR	R (see Note-2)	NR	NR	NR	5000 5000 (see note-4)	NR	NR	NR	NR

Table 23 continue

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	INSTITUTIONAL BUILDING (C) (SEE NOTE -12)													
	A)Hospital sanatoria and Nursing Home (C-1)													
	<u>1)</u> Less than 15m in height with plot area up to 1000m ²													
	i)Up to ground plus one storey with no beds	R	R	NR	NR	NR	NR	R (see Note-2)	R	NR	NR	2500 (2500) (see note-4)	NR	NR
	ii)Up to ground plus one storey with beds	R	R	NR	NR	R	NR	R (see Note-2)	R	NR	NR	5000 (5000) (see note-4)	NR	450 (450) (See note-4)
	iii) Ground plus two or more storey with no beds	R	R	NR	NR	R	NR	R (see Note-2)	R	R	NR	5000 (5000) (see note-4)	NR	450 (450) (See note-4)
	iv) Ground plus two or more storey with beds	R	R	NR	R	NR	NR	R (see Note-2)	R	R	50000	5000 (5000) (see note-4)	See Note 19	NR
	<u>2)</u> Less than 15m in height with plot area more than 1000m ²	R	R	NR	R	NR	R	R (see Note-2)	R	R	100000	10000	See Note 19	NR

	R	R	R	NR	R	NR	R	R	R (see Note-11)	R	R	R	100000	20000	See Note 20	NR
3)15m and above but not exceeding 24m in height	R	R	NR	R	NR	R	R	R	R (see Note-11)	R	R	R	100000	20000	See Note 20	NR
4) Above 24m but not exceeding 30m in height	R	R	NR	R	NR	R	R	R	R (see Note-11)	R	R	R	150000	20000	See Note 21	NR
B) Custodial (C-2) and penal and places (C-2)																
1) Less than 10m in height																
i) Upto 300 persons	R	R	NR	R	NR	R	NR	NR	R (see Note-2)	NR	NR	NR	10000 (500) See note-4	NR	NR	450 (900) (See note-4)
ii) More than 300 person	R	R	NR	R	NR	R	NR	NR	R (see Note-2)	NR	NR	NR	5000 (5000) See note-4	NR	NR	450 (900) (See note-4)
2) 10m and above but not exceeding 15m in height	R	R	NR	R	NR	R	R	R	R (see Note-2)	R	R	R	50000 (5000) See note-4	See Note 20	See Note 20	NR
3) 15m and above but not exceeding 24m in height	R	R	NR	R	NR	R	R	R	R (see Note-10)	R	R	R	10000	See Note 20	See Note 20	NR
4) 24m and above but not exceeding 30m in height	R	R	NR	R	NR	R	R	R	R (see Note-11)	R	R	R	10000	See Note 21	See Note 21	NR

Table 23 continue

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	ASSEMBLY BUILDINGS (D) SEE NOTE -12													
	A) Buildings (D-1 to D-5													
	i) Less than 10m In height													
	<u>i) Upto 300 persons</u>	R	R	NR	NR	R	NR	R (see Note-2)	R	NR	NR	10000 (5000) See note-4	NR	450 (450) (See note-4
	ii) More than 300 person	R	R	NR	R	R	NR	R (see Note-2)	R	NR	NR	15000 (5000) See note-4	NR	900
	2) Above 10m but not exceeding 35m in height	R	R	NR	R	NR	R	R (see Note-2)	R	R	50000	5000 (5000) See note-4	See Note 20	450 (450) (See note-4
	3) Above 15m but not exceeding 30m in height	R	R	NR	R	NR	R	R (see Note-11)	R	R	15000	10000	See Note 20	NR
	4) Above 24m but not exceeding 30m in height	R	R	NR	R	NR	R	R (see Note-10)	R	R	100000	20000	See Note 21	NR
	b) Multi plex D-4	R	R	NR	R	NR	R	R (see Note-10)	R	R	20000	20000	See Note 21	NR
	c) D-7													
	BUSINESS BUILDINGS (E)													
	i) Less than 10m In height	R	R	NR	NR	R	NR	R (see Note-2)	R	NR	NR	10000 (5000) See note-4	NR	450 (450) (See note-4

See details as 6.4.3

		R	R	NR	NR	R (see Note-3)	R	R	R	50000	10000 (5000) See note-4	See Note 20	450 (450) (See note-4)
	2)Above 10m but not exceeding 15m in height	R	R	NR	NR	R (see Note-3)	R	R	R	50000	10000 (5000) See note-4	See Note 20	450 (450) (See note-4)
	3) Above 15m but not exceeding 24m in height	R	R	NR	NR	R (see Note-11)	R	R	R	75000	10000	See Note 20	NR
	4) Above 24m and up to 30m in height	R	R	NR	NR	R (see Note-10)	R	R	R	100000	20000	See Note 21	NR
	5) Above 30m in height	R	R	NR	NR	R (see Note-10)	R	R	R	200000	20000	See Note 21	NR

Table 23 continue

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	MERCENTILE BUILDING (F)													
	A) F-1 & F-2 SEE NOTE -12													
	B) Less than 15m in height.													
	i) Ground plus one storey with total covered area not exceeding with 500m2	R	R	NR	NR	R	NR	R (see Note-2)	NR	NR	NR	5000 (5000) See note-4	NR	450 (450) (See note-4)
	ii) Ground plus one storey	R	R	R	NR	R	NR	R (see	R	NR	NR	25000	NR	NR

Table 23 continue

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	b) Moderate hazard (G-2) SEE NOTE-14													
	i) Build up area upto 300m ²	R	R	NR	NR	NR	NR	R	NR	NR	NR	10000	NR	NR
	ii) Build up area more than 100m ² and upto 500m ²	R	R	NR	NR	NR	NR	R	NR	NR	NR	10000	NR	NR
	iii) Build up area more than 500m ² and upto 1000m ²	R	R	NR	R	R (see Note-7)	R	R	R	R	75000	20000	See Note 20	450
	vi) Build up area more than 1000m ²	R	R	NR	R	R (see Note-7)	R	R	R	R	NR	5000 (5000) See note-4	See Note 20	450
	c) High hazard (G-3) SEE NOTE-16													
	i) Build up area upto 50m ²	R	R	NR	NR	NR	NR	R	NR	NR	NR	5000	NR	450
	ii) Build up area more than 50m ² and upto 150m ²	R	R	NR	NR	NR	NR	R	NR	R	NR	5000	NR	450
	iii) Build up area more than 150m ² and upto 300m ²	R	R	NR	R	NR	NR	R	R	R	25000	10000	See Note 19	450
	iv) Build up area more than 300m ² and upto 500m ²	R	R	NR	R	NR	R	R	R	R	50000	10000	See Note 19	900
	vi) Build up area more than 500m ²	R	R	NR	R	R (see Note-7)	RR	RR (see Note-2)	R	R	100000	20000	See Note 20	900

R-REQUIRED

NR. – NOTREQUIRED

NOTE:-

- (1) Building above 15m in height not be permitted to occupancies A-1 and A-2
- (2) Required to be installed basement if area of basement exceeds 200m²
- (3) Required to be provided if basement exceeds 200m²
- (4) Additional value gives in parenthesis shall be added if basement area exceeds 200m²
- (5) Required to be provided for buildings with more than two storey (Ground +one)
- (6) As per the requirement of local authority dry riser may be used in hilly area, industrial area or as required.
- (7) Required to be provided for buildings height above to 15m
- (8) To be installed in basement. If basement provided is used for car parking and area exceed 750m² than the sprinkler shall be fed water from both underground static water storage tank and terrace tank.
- (9) Required to be provided for buildings with more than one storey
- (10) To be installed in entire buildings.
- (11) To be installed in all floors at appropriate Places and in consultation with local fire authorities
- (12) Buildings above 30m in height not to be permitted for Group B, Group C, Group D, Occupancy
- (13) All underground shopping area should be fully air-conditioned.
- (14) The requirement given in this table for Group G Industrial Buildings are for small scale industry unit. For other industries the requirements will have to be worked out on basis of relevant Indian standards and also in consultation with the local fire authorities.
- (15) Buildings above 18m in height not to be permitted for G-1 and G-2.

- (16) Buildings above 15m in height not to be permitted for G-3 occupancies
- (17) Buildings above 18m in height not to be permitted for Group H and Group J occupancies.
- (18) Pump capacity shall be based on the covered area of the buildings.
- (19) One electric and one diesel pump of capacity 1620 ltr/min and one electric pump of capacity 180 ltr/min (See figure -4)
- (20) One electric and one diesel pump of capacity 2280 ltr/min and one electric pump of capacity 180 ltr/min (See figure -4)
- (21) Two electric and one diesel pump of capacity 2280 ltr/min and one electric pump of capacity 180 ltr/min (See figure -5)
- (22) Two electric and one diesel pump of capacity 2850 ltr/min and one electric pump of capacity 180 ltr/min (See figure -5)
- (23) For buildings 45m and above, the entire capacity of water for fire fighting purpose as required in respective occupancy> if provided as the terrace level the main pump sprinkler pump jockey pump and common pump need not be provided, however our electric fire pump of 900LPM capacity with automatic operation is required to be provided.

APPENDIX-IV

INSTALLATION GUIDELINES FOR DETECTORS (BOTH FOR AFAS, FAS AND INTELLIGENT FAS)

1.0 General:

This section covers general guidelines for installation of following-

- Fire Alarm System
- Automatic Fire Detection and Alarm System
- Fire Detectors of different types.

Equipments (like power supplies etc.) and cables of Fire Detection and Alarm System should be independent of any other system or cables and should not be shared with any other system.

1.1 Zones:-

1.1.1 In buildings wherever an alarm activated it will initiate a number of different activities, e.g. provision of assistance, commencement of fire fighting operations and emergency evacuation procedures, summoning of fire brigade etc. it is essential that these activities are well co-ordinate. It is therefore important, for ease of communication that the building may be divided in number of identifiable sectors/zones.

1.1.2 All buildings with the exception of smaller ones need to be divided into detection zones. The zones need to be small enough for a fire to be located quickly. Even if the system is addressable, zoning indications needs to be provided as this often provides a quicker display. Also this would enable fire fighters who are not familiar with the building to proceed to the location of fire.

1.2 Requirements of detection zones shall be as follows:

1.2.1 The floor area of single zone shall not exceed 2000 sqmtr.

1.2.2 If the total area of a building is less than 300 sqmtr, a zone can cover more than one floor.

1.2.3 If the total area of a building is more than 300 sqmtr, each zone shall be restricted to a single floor.

1.2.4 Voids above or below the floor area of a room, can be included in the same zone. The voids and the room constitute a single compartment.

1.2.5 The traveled distance by anyone responding to a fire alarm signal, shall not exceed 30 mtrs.

- 1.2.6 Any enclosed stairwell, lift well or other enclosed shaft-like structures shall be considered as a separate zone.
- 1.2.7 If manual call points are located on the landings of an enclosed staircase, such points at each level shall be incorporated within the zone that serves the adjacent accommodation on that level.
- 1.2.8 The detectors and manual call points within sectors/zones shall be wired to the control and indicating equipment.
- 1.2.9 The entire electrical installation pertaining to the entire fire alarm system as described above shall be independent of other systems.
- 1.2.10 It is advisable to provide adequate fire separation between the zones.
- 1.2.11 If the requirement of detectors or call points is less than 20 in any area, division of the area into zones is not necessary. Similarly, sectorization is not necessary if the number of zones is not very large.
- 1.2.12 For larger system covering more than one building it may be necessary to create sectors in addition to zones in order to restrict the number of zones from which alarm originate simultaneously or in succession.
- 1.2.13 The division into zones and/ or sectors shall be decided based on careful consideration on the type risk and accessibility of zone in respect of main circulation routes and main control and indicating equipment.
- 1.2.14 Remote indicator lamps outside doors of rooms, cabin etc., within a zone may be useful, if doors are likely to be locked. Making an area easier to search, the use of remote indicator lamps reduced the need for a large number of smaller zones.
- 1.2.15 Where a special risk is present within a larger protected area, e.g. a spray painting both in engineering workshop and it is considered important to obtain rapid identification of fire in that risk, such special risk shall be deemed as a separate zone.

1.3 Size and number of zones (protected with manual call points):

- 1.3.1 In systems containing only manual call points, location of a fire is usually known to the person operating the call point. As it is often difficult to get information in time to the safety personnel, the restriction on the size and number of zones shall also apply to the systems protected with manual call points only.
- 1.3.2 To prevent misleading indication of the position of the fire, it is advisable that manual call points be indicated in the control equipment separately from the detectors in zones, which are protected, by both detectors and manual call points. It is strongly recommended that the circuits for the detectors and the call points shall be different in case of conventional detection systems.

1.4 Sitting of fire Detectors:-

- 1.4.1 At the time of installation and prior to commissioning, every fire detector should be

allotted an identification number, preceded by alphabetic initials showing the type of detectors, for example, Z1/SD(I) 20 meaning Smoke Detector, Ionization, zone 1, 20th detector. Z2/SDOT/3 meaning Smoke detector Optical, Zone 2, 3rd detector, HFT/2 (Fixed Temperature heat detector, 2nd detector), HFR (Rate of rise heat detector) etc. A record of this should be maintained in the control center.

1.5 Spacing and sitting of detector :- (Common to all types of smoke and Heat Detectors).

- 1.5.1 Under flat ceilings, the horizontal distance between any point in a protected area and the detector nearest to that point shall not exceed i) 7.5 mtrs. in case of smoke detector and ii) 5.3 mtrs. in case of heat detector.
- 1.5.2 Under sloping roof pitched ceiling (where the distance between the top of apex and bottom of the roof exceeds 600mm), spacing of detectors at or in the vicinity of apex may be spaced between 7.5 mtrs. to 8.5 mtrs. for smoke detectors.
- 1.5.3 Heat detectors should be installed that sensing element is not less than 25mm and more than 150mm below the ceiling/roof level. For smoke detectors. Sensing element should not be less than 25 mm and not more than 600mm below the ceiling/roof level except as necessary.
- 1.5.4 Detectors shall not be mounted within 500mm of any walls, partitions or obstructions to flow of smoke or hot gases, such as structural beams and ductwork where the obstructions are greater than 250mm in depth.
- 1.5.5 When structural beams or ductwork of any other ceiling attachments, not greater than 250mm depth, create obstacles to the flow of smoke, detectors shall not be mounted closer to the obstruction than twice the depth of the obstruction.
- 1.5.6 Where partitions or storage racks that reach within 300mm of the ceiling, they shall be construed as walls that extend to the ceiling for the purpose of sitting the detectors.
- 1.5.7 Similarly, ceiling obstructions such as structural beams, deeper than 10% of the overall ceiling height shall be construed as walls for the purpose of sitting the detectors.
- 1.5.8 Detectors shall not be mounted within 1000mm of any air inlet (supply air Grills of HVAC system) or a forced ventilation system.
- 1.5.9 A clear space of 500mm is maintained below each detector.
- 1.5.10 Where detectors are constrained to be fixed to the wall, they shall be sited in such away that the top of the detection element is between 150mm and 300mm below the ceiling.
- 1.5.11 Additional detector shall be placed on the ceiling at a position 1500 mm from any opening which might act like a flue.
- 1.5.12 A detector shall be placed on the protected side of the premises on the ceiling

1500mm from any door, window or any opening in the wall partitions separating the protected premises from the other premises.

- 1.5.13 All stairwells, lift shafts, other utility shafts, etc. shall have a detector at the top. Lift machine rooms shall be provided with a detector.
- 1.5.14 All enclosed staircase shall have one detector at each main landing within the staircase.
- 1.5.15 The detector shall also be provided in cable tunnels, ducts, false floors, AC & AHU room, A.C. return ducts and distribution boards, main Board A.C. niches.
- 1.5.16 Every enclosures e.g. room / cabin shall have a detector at ceiling, level and also under false ceiling, if provided.
- 1.5.17 A response indicator shall be installed at the entrance to each room / cabin to the indicated where the detector has actuated. This arrangement shall also be followed in case of all concealed detectors in false floors, plenums, shafts, tunnels, etc.
- 1.5.18 Voids area as in case of false ceiling, false flooring more than 800mm shall also be protected with detectors with spacing like in normal installation. However, voids as in false ceiling / flooring less than 800mm height need not necessarily have independent coverage unless the void is such that the spread of fire products between the rooms or compartments take place through it. Bathroom, lavatories, WC, etc. however, need not be protected.
- 1.5.19 No detector should be subjected to any interior decorations treatment that is painting, alteration of exterior cover etc. to confirm with environment.

1.6 Spacing of Detectors at different Ceiling Height – This is given below in Table- 1

Table – 1
Spacing (s) at Different Ceiling Heights
All values in meters

Type of Detectors		Up to 3.5	Spacing for ceiling Heights (s)							Remarks
			4.0	5.0	6.0	7.0	8.0	9.0	10.0	
1		2	3	4	5	6	7	8	9	10
Smoke detectors conforming to Is 11360 both ionization and optical type		9	No change	No change	No change	7.5	6.5	6.0	5.0	The spacing in corridors should not be greater than 3 S/2
Heat detector conforming to IS 2175	Grade –I (time instant 20 s)	7	No change	6	5	5	4	3	Nil	Spacing From the boundary wall should be kept S/2
	Grade –2 (time instant 40 s)	6	5.5	5	4	3.5	3	Nil	Nil	
	Grade –3 (time instant 60 s)	5	4.5	4	3	3.5	Nil	Nil	Nil	

Note:- The spacings have been adopted from charts of Fire Detection Institute of America, adopting the parameters mentioned in 6.3 (nearest/rounded off values).

Note:- The spacings have been adopted from the charts published by Fire Detection Institute of America and adopted by NFPA (National Fire Protection Association of America). The spacing for parameters of other than those considered here can be found from these charts.

1.7 In case of computer/EDP center/other electronic equipment installed in air-conditioned areas, the following requirements should apply:-

- 1.7.1 Both ionization and optical type (in the ratio of 1:1), smoke detector should be used on cross-zoning pattern.
- 1.7.2 Optical type detector should be used below false floor specially where cable joints exist;
- 1.7.3 The exact location where detectors should be installed on ceiling/below false floor should be determined after observing/studying air movements. This could be done

by suitable smoke generating devices and observing smoke density by suitable measuring instruments; and

- 1.7.4 All the detectors in the rooms, below false floor, above false ceiling or generally hidden should have external response indicators sited at prominent place.

1.8 Compensation to the spacing of detectors:-

1.8.1 Height consideration : Spacing of 7.5 meter for smoke detectors is valid only upto a height of 7 meter only and that 5.3 meter for heat detectors is valid only upto a height of 5 meter. Beyond these heights, spacing between the detectors shall be adjusted as following:

1.8.2 Smoke detectors for ceiling heights between 7 meter and 10 meter : 5 meter spacing.

1.8.3 Above 10 meter ceiling height : Only beam detectors shall be provided.

1.8.4 Heat detectors for heights between 5 meter and 7 meter : 3.5 meter spacing.

1.8.5 Above 7 meter ceiling height : Not allowed to install heat detectors.

1.9 High air movement consideration:

1.9.1 Spacing between detectors shall be suitably reduced in areas where high air movement or where high air changes prevails. Modified values of spacing is given in the following table.

TABLE – 2

Air changes per hour inside block	Multiplying factor for modified	
	Spacing (in meter)	(area coverage) (in Sq. meter)
Less than 7.5	1.00	(1.00)
8.5	0.95	(0.91)
10.0	0.91	(0.83)
12.0	0.83	(0.70)
15.0	0.74	(0.55)
20.0	0.64	(0.40)
30.0	0.50	(0.25)
60.0	0.38	(0.15)

- 1.9.2 Detectors shall not be located in the vicinity of supply air diffusers. Minimum distance between the detector and the air inlets/diffusers shall be at least 1.5 meter.
- 1.9.3 Detectors shall be so mounted as to favour the air flow towards return air openings.
- 1.9.4 After designing the detector spacing, it shall be crosschecked to ensure that there is at least one smoke detector for every 100 m² or one heat detector for every 50 m² of the compartment area.

1.10 Additional requirements for optical detectors:-

- 1.10.1 Optical beam –type detectors shall be sited in such a way that no point in the protected space is more than 7.5 meters from the nearest point of optical beam.
- 1.10.2 In case of a sloping roof or pitched ceiling (where the distance between the top of apex and bottom of the roof exceeds 600 mm), distance stated in 10.11.1 above may be increased to 8.5 meter.
- 1.10.3 Where optical beam type smoke detectors are used more than 600mm from ceiling level in order to provide supplementary detection of rising smoke within a high space (like Atrium etc), the width of the area protected on each side of optical beam shall be regarded as 12.5% of the height of the above beam from ground level.
- 1.10.4 Where there is a probability of people walking through the beam or where the beam is likely to be obstructed by forklifts etc., detectors shall be mounted at a suitable height.
- 1.10.5 Transmitters, Receivers and / or reflectors shall be mounted on a solid construction which shall withstand vibrations, temperatures or any imposed load.
- 1.10.6 The path length of the optical beam shall be within the limits specified by the manufacturers.
- 1.10.7 Beam detection area shall not exceed the detection zone in which it is installed.

1.11 Siting of flame detectors

1.11.1 General

The location and spacing of the detectors shall be based on sound engineering evaluations taking into account the following.

- (a) Size of the fire requiring detection
- (b) Fuel involved
- (c) Sensitivity of detectors
- (d) Distance between the fire and detector
- (e) Radiant energy absorption of the atmosphere
- (f) Presence of other sources of emission
- (g) Purpose of detection system

Certain flame detectors respond to the instantaneous level of radiation received while others depend upon the level received over a period.

In either case the response will depend on the distance between the flame detector and the fire, since the radiation level received is inversely proportional to the square of this distance. Increased distance from the fire will, therefore, lead to an increase in the size of the fire at detection.

A clear line sight to the area being protected is of great importance but at the same time care must be exercised to avoid a direct line sight to likely sources of non-fire radiation to prevent false alarms.

1.12 Spacing guide – line

1.12.1 Sufficient no. of detectors shall be used and they shall be positioned such that no point requiring detection in the hazard area is obstructed or outside the field of view of at least one detector.

1.12.2 The spacing of the detectors shall vary from fuel to fuel. It is therefore necessary to fix the distance as per the recommendations of the manufactures.

1.12.3 The location of the detectors shall also be such that structural members or any other opaque objects or materials do not obstruct their line of sight.

1.12.4 When installed outdoors, detectors shall be shielded to prevent diminishing sensitivity due to rain, snow, ice etc, and allow a clear vision of the hazard area.

APPENDIX –V

INSPECTION, TESTING AND COMMISSIONING

1.0 SCOPE:

This section covers the requirements for testing and commissioning of all types of fire alarm systems/ Automatic Fire Alarm System/ Intelligent addressable fire alarm system.

2.0 Testing before supply

- (i) Detectors, control and indicating panels, sounders, PA system equipment and battery unit with charger etc. shall be tested at the manufacturer's works to indicate satisfaction to the contract specifications, and test certificates be furnished with the supply at site of work by the contractor.
- (ii) In case of imported fire alarm components such as main fire alarm panel, Repeater panel, Smoke , Heat and Beam detectors, Manual Call points, Monitor and Control modules, Response Indicators, etc; individual certificate with individual number confirming to the relevant international standard shall be provided by the contractor at the time of supply at site of work.

3.0 Initial Installation Inspection:

- 3.1 After installation, a visual inspection of all the detectors should be made to make sure that they are property placed. Each detector should be inspected to ensure that it is properly mounted and connected.
- 3.2 Restorable heat detectors and restorable elements of combination detectors should be tested by a heat source , such as a hair dryer, or shielded heat lamp until it responds, making sure that the sensing element is not damaged. After each heat test, the detector should be reset precaution should be taken to avoid damage of the non- restorable fixed temperature element of a combination rate of rise /fixed temperature detector.
- 3.3 Non-resettable fixed temperature heat detectors which are not to be heat-tested should be tested mechanically or electrically for fire alarm function.
- 3.4 Heat detectors with replaceable fusing alloy element should be tested first by removing the element to see whether contact operate properly and then reinserting them in proper position.
- 3.5 In periodic testing, heat detectors should be visually examined for damaged for other conditions (such as heavy coats of paints etc. likely to interfere with the correct operation)
- 3.6 Each smoke detector should be tested to initiate an alarm at its installed location with smoke or other approved aerosol which demonstrates that the smoke can enter

the chamber and initiate an alarm.

- 3.7 In order to ensure that each smoke detector is within its sensitivity range, its sensitivity range, it should be tested using either.
- a) A calibrated test method, or
 - b) A manufacturer's supplier's approved calibrated sensitivity test instrument, or
 - c) Approved control equipment for the purpose, or
 - d) Other approved calibrated sensitivity test method.

- 3.8 Detectors found to have a sensitivity outside the approved range should be replaced.

Note : Detectors sensitivity cannot be tested or measured using any spray/smoke producing device that administers an unmeasured concentration of aerosol/smoke into the detector.

4.0 Testing after installation:

Following tests shall be conducted in a completed FAS/AFAS/intelligent addressable FAS installation, in the presence of the Engineer-in-Charge and the test certificate shall be furnished for the following test.

- (i) Continuity test.
- (ii) Test for insulation resistance of the wiring and the control and indication panels.
- (iii) Test for system operation. In the case of AFAS (See note below), this test for fire conditions shall be conducted using a test fire at normal floor level. The number of locations for such a test shall be 1% of the total number of detectors in an installation subject to a minimum of two and maximum of five. The system operation for fault conditions shall be conducted by introducing faults such as open circuit, short circuit, removal of detector, open/short circuit in a sounder circuit etc.

Note: Use of a test fire in the case of installation using heat detectors need not be insisted upon.

5.0 Inspection by local bodies

It shall be the responsibility of the contractor to get the installation inspected and passed by the local authorities concerned, as may be required by the local bye-laws, including payment of necessary inspection fee and an 'No Objection Certificate' (N.O.C) shall be obtained from the authority.

APPENDIX –VI

MAINTENANCE OF THE FIRE ALARM SYSTEM

1.0 SCOPE:

This section covers the inspection and maintenance schedule for all types of Fire Alarm installation. Even a well designed and properly installed fire alarm system will not be able to render reliable and trouble-free service unless high standards of maintenance and supervision are ensured during the entire service period of the system. Regular inspections and scheduled preventive maintenance are critical and should include all the components of the system.

1.1 Servicing / Periodical Maintenance

1.1.1 To ensure that regular and reliable servicing /maintenance of the systems and its components is carried out, any of the following methods should be adopted.

- (a) Through an agreement/contract with the same contractor who had executed the work as far as possible for a period of 5 years for maintenance & repair of system or any other competent agency as decided by department.
- (b) Where no such service contract can be entered into for any reason, at least one qualified employee of the user with suitable experience of electrical equipment should undergo special training to deal with all aspects of basic servicing and maintenance, including routine sensitivity test/ checks of the detectors, as and when require.

1.2 Maintenance Schedule:

1.2.1 The user of the equipment to ensure that proper instructions are obtained from the manufacture/supplier or installer regarding the routine maintenance and test procedures.

1.2.2 The routine to be adopted in individual premises may vary with the use of the premises, equipment installed in corrosive or dirty environmental conditions will need to be checked more thoroughly and at more frequent intervals than that in clear dry situations.

1.2.3 Daily Attention by the user:

A check should be made every day to ascertain that:

- (a) The panel indicates normal operations : if not, that any fault indicated is recorded in the log book and is receiving urgent attention : and
- (b) Any fault warning recoded the previous day has received attention.

1.2.4 Weekly attention by the user:

The following tests should be made every week to ensure that the system is capable of operating under alarm conditions.

- (a) Once a week, at least one trigger device or end of line switch on one zone circuit should be operated to test the ability of the control and indicating equipment to receive a signal and to sound the alarm and operate other warning devices. If there is more than one zone on a system having unmonitored wiring, each unmonitored zone should be tested each week, but without sounding the alarm more than once. For systems having monitored wiring and up to 13 zones, each zone should be tested in turn but if there are more than 13 zones, more than one zone may need to be tested in any week so that the interval between tests on one zone does not exceed 13 weeks. It is preferable that each time a particular zone is tested, a different trigger device is used. An entry should be made in the log book quoting the particular trigger device that has been used to initiate the test. If the operation of the alarm sounder and/or the transmission of the alarm signal has been prevented by disconnection, then a further test should be carried out to prove the final reinstatement to the sounders, and if permissible, the alarm transmission circuits: and
- (b) A visual examination of the battery and connections should be made to ensure that they are in good condition. Action should be taken to remedy any defect.
Any defect noticed should be recorded in the log book and reported to the responsible person, and action should be taken to correct it.

1.2.5 Quarterly inspection and test by the User:

The following check- list and test sequence should be carried out:

- (a) Entries in the log book since the previous inspection should be checked and any necessary action taken.
- (b) Batteries and their connections should be examined and tested to ensure that they are in good serviceable condition.
- (c) Check the Batteries for their proper functioning.
- (d) The alarm function of control and indicating equipment should be checked by the operation of a trigger device in each zone as described. The operation of alarm sounders and any link to a remote manned center should be tested. All ancillary functions of the control panel should also be tested where practicable. All fault indicator and their circuits should be checked preferable by situation of fault conditions.
- (e) Any defect should be recorded in the log book and reported to the responsible person, and action should be taken to correct it.

1.2.6 Annual Inspection Tests:

The following checks and test sequence should be carried out.

- (a) Operation of at least 5 percent of the detector in an installation should be checked each year.
- (b) Each detector should be checked for correct operation using specified test equipment and method.
- (c) Visual inspection should be made to confirm that all cable fittings and equipment are secure, undamaged and adequately protected.
- (d) On completion of the annual inspection, the entry should be made in register in respect of defects found. After the defects are rectified the entries should then again be made.

1.2.7 Clearing and Maintenance:

Detectors require periodic cleaning to remove dust or dirt that has accumulated, the frequency of cleaning depending on the type of detector and the local ambient conditions. In any case, the interval should not exceed a period of 6 months. For each detector, the cleaning, checking, operating and sensitivity adjustment should be attempted only consulting manufactures instructions. These instructions should details method such as creating vacuum to remove loose dust and insects, and cleaning heavy greasy deposits, etc.

1.2.8 Tests following an Alarm or Fire:

All detectors suspected of exposure to a fire condition should be tested in accordance with the provisions contained in this code pertaining to annual inspection test. In addition, a visual check of the battery charger should be carried out to ensure perfect serviceability.

However, a check should be made to the extent of damage, if any, to the cables and other components and also the systems as whole.

1.2.9 System Disconnection During Testing:

Care should be taken to minimize the disruption of the normal use of the building by alarm sounding during detector testing. If detectors are removed for testing or servicing, replacement detectors should be provided.

1.2.10 It shall be the responsibility of the contractor to get the installation inspected and passed by the local authorities concerned; as may be required by the local by laws, payment of necessary inspection fee shall be paid by Department.

APPENDIX –VII

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title
694: 2010	Polyvinyl chloride insulated unsheathed and sheathed cables/ cords with rigid and flexible conductor for rated voltages up to and including 450/750 V (fourth revision)
1255 : 1983	Code of practice for installation and maintenance of power cables upto and including 33 KV rating (second revision)
1554(Part-I): 1988	PVC insulated (heavy duty) electric cables: Part 1 for working voltage upto and including 1100 V (third revision)
2175 : 1988	Specification for heat sensitive fire detectors for use in automatic fire alarm system (Second revision)
9968(part 1) :1988	Elastomer insulated cables : Part 1 for working voltage upto and including 1100 V (first revision)
11360 : 1985	Specification for smoke detectors for use in automatic electrical fire alarm system.
2189 : 2008	Code of Practice for selection , installation and maintenance of Automatic fire detection and alarm system (second revision)- Code of Practice
	National Building Code, 2016