

PART C

PART C-1
IEI WORKS, FIRE
DETECTION & ALARM
SYSTEM AND LIFTS

Eligibility criteria for associate contractor (SH: SITC of IEI Works)

Name of work:- Construction of Faculty Building Annexe (G+5) including Internal water supply, Sanitary installation, Internal electrical installations, Fire Fighting, Fire Alarm system, Lifts, HVAC (Low side)& BMS, development works and all other related works to make the building functional on Engineering, Procurement and Construction (EPC) contract basis at IIT Kanpur.

1. Eligibility condition for Associate agency for work of SITC of IEI Works.

- (a) The associate agency having valid electrical license.**
- (b) The associate agency should have successfully completed works, as mentioned under during last 7 years ending previous day of last date of submission of tender.**
 - (i) Three similar works each of value not less than Rs. 226 lakhs**

OR

- (ii) Two similar works each of value not less than Rs. 340 lakhs**

OR

- (iii) One similar work each of value not less than Rs. 453 lakhs**

Similar works means SITC of IEI Works.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to the previous day of last date of submission of tenders, calculated on daily basis.

2. The Composite category contractor shall also be eligible to carry out himself the work without associating any specialized agency provided:

He fulfills the prescribed eligibility criteria respectively for this work. or

He directly procures the equipment of approved make from manufacturer and gets it installed from authorized agency/service provider of the manufacturer or specialized agency as per criteria mentioned in the tender document.

3. The main contractor/agency has to submit detail of such associate agency to Engineer-in-charge (of SITC of IEI Works.) within one month from date of start of work. The associate agency shall be approved by Engineer-in-charge (SITC of IEI Works.) after the receipt of the details as mentioned in serial no. 4 below. In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge (SITC of IEI Works.). The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the main contractor to change the agency executing such items of work and this shall be binding on the contractor.

4. Associate Agency shall enclose self attested copies of the following documents.

a. The contractor should be registered in any department of CPWD, BSNL, MES, PWD, Railways, Central PSUs/ State PSUs in the appropriate class.

b. Valid Electrical License in appropriate class.

c. The firm should be registered with GST and shall submit the copies of upto date GST filed return.

d. Self attested copies of completion certificate(s) issued by the officer of the client department, not below the rank of Executive Engineer or equivalent, for works executed in Government and in cases of private works certificates signed by the Consultant / Engineer/ Architect In charge and counter-signed by the owner of the building for whom the work has been carried out, will have to be furnished along with the application. The completion certificate must have the following details:-

- i. Stipulated date of start and actual date of completion.**
- ii. Attested copy of the final bill with matching 26AS downloaded from website (TDS) for accessing the Value of & SITC of IEI Works.**
- iii. That the work has been completed satisfactorily.**
- iv. Full address of the client, officer issuing certificate and location, where work is executed.**

MEMORANDUM OF UNDERSTANDING [M.O.U] BETWEEN

1] M/S [Name of the firm with full address]

Enlistment Status

Valid Upto:

[Henceforth called the main contractor]

And

2] M/S [Name of the firm with full address]

Enlistment Status

Valid Up to:

[Henceforth, called Associated Contractor]

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[Electrical component only] as per schedule, specifications, terms and conditions of the tender.

We state that M.O.U. between us will be treated as an agreement and has legality as per Indian Contract Act (amended up to date) and the department (IWD) can enforce all the terms and conditions of the agreement for execution of the above work. Both of us shall be responsible for the execution of work as per the agreement to the extent of this MOU allows. Both the parties shall be paid consequent to the execution as per agreement to the extent this MOU permits.

We have agreed as under :

- 1- The associated contractor shall be liable for disciplinary action if he fails to discharge the action(s) and other legal action as per agreement besides forfeiture of the security deposit.
- 2- All the material, machinery and equipments, tools and tackles required for execution of the electrical works. As per agreement shall be the responsibility of the associated contractor.
- 3- The site staff required for the electrical work shall be arranged by the associated contractor as per terms and conditions of the agreement.

SIGNATURE OF MAIN CONTRACTOR

Date :

Place:

SIGNATURE OF ASSOCIATED CONTRACTOR

Date:

Place:

**COUNTERSIGNED
EXECUTIVE ENGINEER (E)**

WILLINGNESS CERTIFICATE

Name of Work: Construction of Faculty Building Annexe (G+5) including Internal water supply, Sanitary installation, Internal electrical installations, Fire Fighting, Fire Alarm system, Lifts, HVAC (Low side)& BMS, development works and all other related works to make the building functional on Engineering, Procurement and Construction (EPC) contract basis at IIT Kanpur.

I will execute the work as per specifications and conditions for the agreement and as per direction of the Engineer-in-charge. Also I will employ full time technically qualified supervisor for the works. I will attend inspection of officers of the department as and when required.

“I/We undertake and confirm that eligible similar work(s) has /have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in IWD contracts in future forever.”

“I have also read the complete tender conditions and I am aware that PART-A of this tender document is applicable to me also”

Date:

Signature of Contractor

PROFORMA OF SCHEDULES
(SH:- SITC of IEI Works)

SCHEDULE 'A' SITC of IEI Works

Schedule of Quantities (as per PWD-3)As per separate sheet attached for Electrical Items of Work.

SCHEDULE 'B' Schedule of materials to be issued to the contractor:

S. No.	Description of item	Quantity	Rates in figures & words at which the material will be charged to the contractor	Place of issue
1	2	3	4	5
----- NIL -----				

SCHEDULE 'C' Tools and plants to be hired to the contractor

S. No.	Description	Hire charges per day	Place of issue
1	2	3	4
----- NIL -----			

SCHEDULE 'D'

Extra schedule for specific requirements/document for the work, if any: As attached in tender form

SCHEDULE 'E'

Reference to General Conditions of contract – **As per PART-A.**

Name of Work: Construction of Faculty Building Annexe (G+5) including Internal water supply, Sanitary installation, Internal electrical installations, Fire Fighting, Fire Alarm system, Lifts, HVAC (Low side)& BMS, development works and all other related works to make the building functional on Engineering, Procurement and Construction (EPC) contract basis at IIT Kanpur.

Estimated cost of work: Electrical Items of Work Rs. 5,66,81,773/-

i) Earnest money: Included in Civil component

ii) Performance Guarantee: Included in Civil component

iii) Security deposit: **As per major component**

GENERAL RULES & DIRECTIONS :

Officer inviting tender: **As per PART-A.**

Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 **As per major component**

SCHEDULE 'F'

Definitions:

- 2(v) **Engineer-in –Charge** Executive Engineer, Elect. Division
IWD, IIT Kanpur or
successor thereof.
- 2(vii) **Accepting Authority** As per Major Component.
- 2(x) **Percentage on cost of materials and labour to cover
all overheads and profits** 15%
- 2(xi) **Standard Schedule of Rates:**
Electrical Items of Work: PAR-2019, Schedule of rates – 2018 & MR
- 2(xii) **Department:** Institute Works Department
- 9(ii) **Standard IWD contract Form:** As per Major Component.

Clause 1 Time allowed for submission of Performance Guarantee, Programme Chart (Time and Progress)
Maximum allowable extension with late fee @ 0.1% per day of Performance Guarantee amount beyond the period provided in (i) above

As per Major Component.
As per Major Component.

Clause 2 Authority for fixing Compensation under Clause-2

As per Major Component.

Clause 5	Number of days from the date of issue of letter of acceptance for reckoning date of start	As per Major Component.
	Time allowed for execution of work	As per Major Component.
	Authority to decide: Extension of time	As per Major Component.
	ii) Rescheduling of mile stones	As per Major Component.

Clause 6, 6A

Clause applicable

6A

Clause 7

Gross work to be done together with net payment/Adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment

} **As per Payment Schedule**

Clause 7A	Whether Clause 7A shall be applicable	Yes
Clause 10A	List of testing equipments to be provided by the contractor at site lab.	As per Annexure-1 (SITC of IEI Works)
Clause 10 B (ii)	Whether clause 10-B (ii) shall be applicable.	NO
Clause 10 C		NO

Clause 10 CA

Clause 10CA	Nearest Materials (other than cement, Reinforcement bars and Structural Steel) for which All India Wholesale Price Index to be followed:	Base Price of all the materials covered under clause 10CA :
Materials Covered under this clause :		
NIL		

Clause 10 CC	Clause 10CC to be applicable in contracts with stipulated period of completion exceeding the period shown in next column	Applicable
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Schedule of component of other Material, labour, POL etc. for price escalation.

(i)	Component of Electrical construction Material expressed as percent of total value of component work:	Xm...75%
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(ii)	Component of Labour: expressed as percent of total value of component work. NOTE:-Payment under this clause is admissible when contractor submits proof of having paid wages due to every worker through bank or ECS or online transfer to his bank account.	Y...25%
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(iii)	Component of P.O.L.:- expressed as percent of total value of component work.	Z.....NIL....%
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Clause 11

Specification to be followed for execution of work:
 IWD's General Specification for Electrical Works Part-I (Internal)-2013, Part-II (External)-1994, CPWD general specification for heating, Ventilation, & air-conditioning works (HVAC)2017 with correction slips Uptolast date of receipt of tender. (Hereinafter called CPWD specifications also) and NBC 2016.

Clause 12	Type of work	Original work
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12.2 Extra/Substituted Item Applicable

Clause 16 Competent Authority for Deciding reduced rates:

For Electrical Items of Work :

SE , IWD, Kanpur or successor thereof.

Clause 17 Defect liability period

36 months from the date of handling over of the complete work.

Clause 18 List of mandatory machinery, tools & plants to be deployed by the contractor at site. As per Annexure-1 (SITC of IEI Works)

Clause 25 Constitution of Dispute Redressal

Same as per Major component

Clause 32 Committee (DRC)-

Requirement of Technical Representative(s) and recovery Rate(For this component of sub work only) . The requirement mentioned here is over and above the requirement detailed in part-A

SI No	Requirement of Technical staff (of this subwork)		Minimum experience in Year	Designation	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 32 Figures Words	
	Qualification	Number				
1	Graduate Engineer or Diploma Engineer	1 (E&M Engineer)	2 (in case of degree in Electrical Engg) or 5 (in case of diploma in electrical Engg.)	Project/ Site Engineer	Rs. 40,000/-	Rupees Forty Thousand only per month per person

Assistant Engineers retired from Government services who are holding Diploma will be treated at par with Graduate Engineers.

N.A.

N.A.

Clause 38

N.A.

- i) a) Schedule/ statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule of Rates 2013 printed by CPWD**
- ii) Variations permissible on theoretical quantities**
 - a) Cement for works with estimated cost put to tender not more than Rs. 5 lakhs.**

Nil

N.A.

For works with estimated cost put to Tender is more than Rs. 5 lakhs

- b) Bitumen all works**
- c) All other materials**

RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION

SI No	Description of items	Rates in figures and words at which recovery shall be made from the contractor	
		Excess beyond permissible variation	Less use beyond the permissible variation
NIL			

Annexure-1 (Internal Electrical Installation works)

Clause- 10 –A & 18

List of mandatory machinery, tools and plants & testing Equipment to be deployed by the contractor at site

1. Steel/Aluminium Ladder 1.5 m to 8 m.	2 Nos.
2. Chase cutting machines.	2 Nos.
3. Electrical wire drawing equipment.	2 Set.
4. Torque wrench for nut/bolt/screws.	2 Nos.
5. Conduit die set.	2 Set.
6. Pipe vice.	1 No.
7. Bench vice.	1 No.
8. L.T.Megger 500/1000 volts.	1 No.
9. Tong Tester.	1 No.
10. Multimeter.	1 No.
11. Hydraulically operated & hand operated crimping machine.	1 No.
12. Earth tester.	1 No.
13. Portable Ordinary drilling machine.	2 Nos.
14. Portable Hammer drilling machine.	2 Nos.
15. Overhead conduit puller.	1 No.
16. welding machine	1 No
17. Metal Grinding machine (Hand held)	1 No
18. Drill machine	1 No

Additional conditions for Internal Electrical Installation works for Construction of Faculty Building Annexe (G+5) including Internal water supply, Sanitary installation, Internal electrical installations, Fire Fighting, Fire Alarm system, Lifts, HVAC (Low side)& BMS, development works and all other related works to make the building functional on Engineering, Procurement and Construction (EPC) contract basis at IIT Kanpur.

1. **Specification :-** The work shall be executed as per CPWD General Specifications for Electrical Works Part I Internal – 2013 & Part II – External 1994, CPWD General Specifications for Electrical Works Part IV Sub Station – 2013 with correction slips upto last date of receipt of tender (Hereinafter called CPWD specifications also), Indian Standards amended upto last date of receipt of tenders, NBC 2016, IE Rules, and as per direction of Engineer-in-Charge. However, if the specification detailed herein is not manufactured, the standard practice for reputed manufacturers shall be adopted.
2. **Test Certificate :-** Test certificate for the work carried out shall also be submitted.
3. The makes of material have been indicated in the list of acceptable makes. No other make will be acceptable. The contractor shall have to prove bonafides of the make of materials by producing necessary documentary evidence. The material to be used in the work shall be got approved from the Engineer-in-Charge before use at site. The Engineer-in-Charge shall reserve the right to instruct the contractor to remove the rejected material and material which, in his opinion, is not as per specifications.
4. Contractor shall preserve the copies of invoices, test certificates, gate passes etc.
5. Materials, equipments, manufacturing process, documents etc for the work may be inspected by the departmental officers/Engineers at various stages (manufacturing, assembling, storage/ godown, transportation, etc) to ensure proper quality of the material. However the final responsibility of quality shall rest with the contractor. All the test reports shall be submitted before the dispatch of equipment. If desired by the engineer-in-charge, inspection at factory or at godown of the manufacturer, as required, shall be arranged by the firm for a mutually agreed date.
6. Agency will be required to procure all materials directly from the manufacturer/ authorized dealers / distributors to ensure genuineness & quality and as per the approved makes only. Proof in this regard shall be submitted by the contractor by the department.
7. No inspection outside the country is permissible. If required so, the same will be deemed to be waived off and necessary test reports shall be submitted before the dispatch of equipment. The contractor shall be fully responsible for such items of materials.
8. **Works to be done by the contractor:-** Complete work including testing and commissioning etc. as per drawings and additional technical specification for IEI works and ancillary works related to make the item functional and as per manufacturer specification and related document.
9. **Structural Alterations to Buildings:-**
 - a. No structural member in the building shall be damaged/ altered, without prior approval from the competent authority through the Engineer-in-charge.
 - b. Structural provisions like openings, cutouts, if any, provided by the department for the work, shall be used. Where these required modifications or fresh provisions are required to be made, such contingent works shall be carried out by the contractor at his cost after written approval of the Engineer In charge.
 - c. All such openings in floors provided by the department shall be closed by the contractor after installing the cables/conduits/rising mains etc. as the case may be, by any suitable means as approved by the Engineer-in-charge without any extra payment.

11. Drawings:-

- a) After award of the work, the contractor will be required to submit the design and shop/execution drawings for the proposed work including layout plan, conduit routes etc. Work will be carried out as per the approved shop/execution drawings.
- b) All circuits shall be indicated and numbered in the lay out plan with mentioning their respective distribution board and circuit number from which they are electrically connected.
- c) Position of all points with their control switch boards indicating their number shall be marked in wiring lay out plan.
- d) All the electrical panel boards, distribution boards duly numbered shall be marked in wiring lay out plan.
- e) For fabricated equipments, the contractor will first submit dimensional detailed G.A. drawings for approval before fabrication is taken up in the factory.

12. **Defect Liability:-** The defect liability period for the work is 36 months from the date of completion of the building. Following conditions are elaborated as follows.

- a) Repair/replacement of defective wire cables, switches, sockets, ACB'S, MCB'S, MCCB'S, contactor, relay, meters, batteries, earth pits, etc. within 48 Hrs on receipt of complaint from operational staff.
- b) Replacement of items against any manufacturing defects noticed during defect liability period.
- c) The bidder shall submit the five year onsite replacement warranty of defective LED luminaries from OEM.

13. **Interchangeability:-** Similar parts of all switches, lamp holders, distribution fuse boards, Switch gears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

14. Workmanship:-

- a) Good workmanship is an essential requirement to be complied with. The entire work of manufacture / fabrication, assembly and installation shall conform to sound engineering practice.
- b) The working contractor shall be a licensed electrical contractor of appropriate class suitable for execution of the electrical work. He shall engage suitably skilled/licensed workmen of various categories for execution of work supervised by supervisors / Engineer of appropriate qualification and experience to ensure proper execution of work. They will carry out instruction of Engineer-in-charge and other senior officers of the Department during the progress of work.

15. **Main Board and Main Distribution Board:-** The design and GA drawings of all Main/Distribution panels shall be prepared by panels manufacture and got approved by Engineer in-charge before fabrication. The panels shall be fabricated according to approved GA drawings/ details. Factory inspection of panels of engineer in-charge shall be planned before dispatch at site. All main panels/Distribution panels shall be provided with MCCB of appropriate capacity as per single line diagram The panels shall be fabricated according to the drawings / details are as approved by the Engineer-in-Charge. All termination of electrical cables in panel / feeder pillars DB's, cable-looping box etc. shall have to be done with proper thimbles / lugs using crimping process. Copper thimbles / reducer shall be used for copper cable, GI earth wire, aluminum thimbles/reducer for aluminum cable and nothing extra will be paid for the same. All multi-stranded/stranded copper wires shall be terminated through copper lugs.

16. All panels, DB's, cable-looping boxes will be numbered and marked with paint / name plate and nothing extra will be payable on this amount.

17. “Modular Switch, Socket, plate, box, Computer outlet, Telephone outlet, accessories” shall be of the same make in one board. The contractor shall have to make the edges around the boxes wherever required shall have to be made by the contractor for which nothing extra shall be paid.

18. All items of interrelated works considered necessary to make the installation complete and operative are deemed to be included shall be provided by the contractor at no extra cost.

19. Wherever ceiling roses are not required to be provided in the light/fan/exhaust fan points, due to site conditions, the contractor shall use suitable three pin connectors for which nothing extra shall be paid.

20. Contractor shall provide polythene / PVC plastic cover for all MDB's/SDB's/DB's, panels, feeder pillars etc. to protect them from rust /damages, during execution of work till the work is actually completed and handed over to the department.

21. The MCB and MCCB should be of the same make as that of DB in all DBs items.

22. 36 months onsite warranty shall be provided to all items except the items of LED fittings and fixtures. For the LED lighting fixtures 60 months onsite replacement warranty shall be provided. Such replacement shall be done within a reasonable period, failing which suitable penalty will be imposed as detailed in part-A of the tender documents.

ADDITIONAL TECHNICAL SPECIFICATION FOR INTERNAL ELECTRICAL INSTALLATION WORKS FOR Construction of Faculty Building Annexe (G+5) including Internal water supply, Sanitary installation, Internal electrical installations, Fire Fighting, Fire Alarm system, Lifts, HVAC (Low side)& BMS, development works and all other related works to make the building functional on Engineering, Procurement and Construction (EPC) contract basis at IIT Kanpur.

1. SCOPE OF WORK

1.1 The general character and the scope of work to be carried out under the contract are illustrated in Drawings. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer In charge. The contractor shall furnish all labour, materials and equipment to complete the work as per additional condition for IEI works, drawings and specifications enclosed. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract.

Complete building to be designed but execution shall be done only in finished areas of ground floor and complete area in first floor of building as shown in shaded areas of drawings. In Unfinished areas in the building the contractor will not provide wirings, Light fixtures, fans, power point outlets and final MCB distribution boards.

The brief of the works to be executed by the contractor and the system shall include:

- a) Wiring for Normal electric supply & Emergency supply shall be done in metallic steel rigid conduit / Cable tray/ O. H. Raceway system as per drawings.
- b) Switches, plug sockets, cover plates and other wiring accessories.
- c) Non designed verified CPRI approved Main L.T. panel, Non metered Sub distribution board panel 1 & 2 and UPS output panel 1 & 2 at ground floor, Metered Main distribution panels on each floor and final MCB distribution boards only at ground and first floor as per SLD and DB detail and plan layout drawings.
- d) Cables from Main L.T. Panel to all respective floor Metering main distribution panels/ Common areas sub distribution panels on cable trays / surface including installation, cable trays, hangers, supports, cable terminations i/c all fixing accessories.
- e) Finishing of available RCC floor level below and around the floor mounted Metered Main L.T. panel, Non metered Sub distribution board panels and UPS output panels suitable to their installation and operation.
- f) Cables/Sub main from Metering main distribution panels boards / Common areas sub distribution panel boards to final DBs in ground and first floors on cable trays / surface including installation, cable trays, hangers, supports, cable terminations and i/c fixing accessories
- g) Earthing (Grounding) System and Lightning Protection System as per NBC-2016.
- h) Cable connections from substations panel to main Building panel and UPS shall not be in scope.
- i) LED Lighting Fixtures, Fans and power point outlets in finished areas of ground floor and complete area in first floor of building as shown in shaded areas of drawings .

1.2 RELATED DOCUMENTS

More particularly following documents should be strictly followed.

1. All Drawings.
2. Additional conditions and additional technical specification for IEI works in this tender.
3. CPWD General Specification for Electrical work Part-1 Internal (2013)

4. CPWD General Specification for Electrical work Part-2 External (1994)
5. Relevant Bureau of Indian Standard codes as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to. Manufactures specification
6. National Building Code – 2016
7. National Electrical Code – 2008
8. Indian Electricity Act 2003
9. The Electricity Rule 1956

2. SUB MAINS AND POINT WIRING

2.1 Scope

The scope of this section comprises the supply, installation, testing and commissioning of following as per drawings:

1. Wiring for power and UPS outlets, heavy duty sockets/industrial sockets.
2. Wiring from distribution boards to different switchboards and from there onwards to individual points like light points, Bell Buzzers, Fan points and small exhaust fan points etc for all internal areas.
3. Switchboards, power plugs and its accessories like gang box, front plate, switch etc.
4. Wires and its accessories like conduits, Outlet boxes, junction boxes, pull-through boxes etc.
5. Ceiling rose, Connectors etc. for light points, Fan points, small exhaust fan points etc for all internal areas.
6. Conduit/channel as the case may be, accessories for the same and wiring cables between the switch box and the point outlet, loop protective earthing of each fan/ light fixture.
7. All fixing accessories such as clips, screws, raw plug etc. as required.
8. Metal switch boxes (as specified) for control switches, regulators, sockets etc, recessed or surface type, and phenolic laminated sheet covers over the same.
9. Control switch or MCB, as specified in drawings.
10. Connections to ceiling rose, connector, socket outlet, switch etc.
11. Flexible conduits from ceiling junction box to the fittings shall be provided duly coupled at both ends where false ceiling is coming. This shall be included within the scope of point wiring.)
12. Interconnecting wiring between switches within the switch box on the same circuit.
13. For any other Items drawings shall be refer.

2.2 Specifications

2.2.1 Wires:

The wires shall be PVC Insulated Copper Conductor multi strained FRLS confirming to IS: 694 and amendment up to date.

- a. Wires for all electric supply for light/Fan circuit wiring and point wiring (along with internal loop earthing) shall be of as per CPWD Specification.
- b. Wires from DB to 6A Socket outlet (along with internal loop earthing) shall be of 2.5 sq.mm size.
- c. Wires from DB to 6/16A Socket outlet (along with internal loop earthing) shall be as per CPWD Specification.
- d. Wires from DB to socket outlets more than 1 KW, Split AC, Geyser, Industrial sockets and Sheet steel MCB/MCCB box shall be as per drawings.

2.2.2 Thimbles/lugs:

The wires shall be terminated with the help of crimping lugs at both the terminals. The lugs shall be suitable for 1100V and the min temperature rating for these lugs shall be 150 degree Celsius. The lugs shall be pin/Hole type with pin designed in such a fashion to prevent damage to the wire from over tightening and ensure a reliable electrical connection. If Aluminum cable is used, aluminum lugs shall be used, for copper cables, copper lugs shall be used and if cable termination is of aluminum conductor and main bus bar is copper than tinned copper or bi-metallic lugs shall be used.

2.2.3 Metallic conduits, Fittings and accessories:

Wiring for Light/ Fan/Call Bell/Exhaust Fan point and circuit wiring and power wiring shall be done in Metallic rigid steel conduit confirming to IS 9537 with conduit fittings confirming to IS 14768 and conduit accessories confirming to IS 3837 amendment up to date.

2.2.4 Modular GI Box:

The switch box for mounting modular switches and sockets shall be made out from pre galvanized sheet. The modular GI box having wall thickness not less than 1.2mm for boxes up to size of 20 cm X 30 cm and above this size of 1.6 mm thick shall be used.

2.2.5 Modular Base and cover plate:

The front plate shall have smooth surface from both the side and shall be properly matching the fixing alignment. Perfect alignment shall be maintained while fixing of the back boxes. The color shall be as per the engineer in-charge.

2.2.6 Switch - Socket Outlets:

The switch sockets shall be modular type of reputed make mentioned in preferred approved make list.

2.2.7 Blanking Plate:

Spare space in modular switch box shall be covered by blanking plate.

2.2.8 Electronic fan regulator:

Step Type two module modular Electronic regulators should be used.

3. DISTRIBUTION BOARD:

3.1 The distribution board shall be made out of CRCA sheet steel with powder coated double metallic door with minimum IP: 42 protection compliance to IS: 8623-1 and 3 and IEC 61439-1 & 3 and amendment up to the last date of receipt of tender.

4. CABLES TRAYS AND RACEWAYS: 4.1

CABLE TRAY

Cable tray system shall comprise of perforated painted with powder coating M.S. cable trays with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with M.S. suspenders including bolts& nuts, painting suspenders including bends, Tee joints, Cross member and reducers etc as required.

4.2 RACEWAY

1. Material Pre galvanized sheet raceway trunking system with openable cover confirming to EN 50 085 - 2 – 2 shall be used.

2. Metal raceways combines with Junction Boxes, back Boxes for wiring devices, fixing and coupler accessories shall be of same manufacture of raceway selected.

3. Standard Thickness: 1.5mm for Body and Cover / 1 mm for divider.

5. LIGHTNING PROTECTION AND EARTHING SYSTEM:

The buildings specified are to be provided Class-II mesh type lightning protection system with Type-B Earthing protection confirming to national building code 2016, Part-8, Section-2. In case NBC does not elaborate a particular parameter, IEC-62305 may be referred.

6. LED LIGHTING FIXTURES:

The contractor shall submit LM 79 report of the LED Luminaries & LM 80 report from LED manufacture before fixture supplied at site. The make of LED used shall be CGL/Philips/Havells/ Wipro / Decon.

All lighting fixtures shall comply the following specifications.

Lumens	≥ certain value as specified in drawings.
Efficacy	≥ 100 for indoor lighting fixtures and > 120 for highway and outdoor luminaries.
CRI	≥ 80 for indoor lighting and 70 for external lighting.
Power Factor	≥ 0.95
THD	≤ 10 %
Surge Protection	2.50KV for indoor and 5 KV for outdoor lighting fixtures.
Operating voltage	150-270 volt.
Useful life of LED's	50000 hours @ L70.

7. MAIN LT Panels/DISTRIBUTION PANELS:

Distribution Panels and Final Distribution Boards shall be covered under this section. Panels/Boards shall be suitable for operation on 3 Phase 4 wire system 415 volts/single phase 2 wire system 240 volts, 50 cycles, with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by an approved manufacturer. Distribution panels shall comply with the latest Relevant Indian Standards, National building code-2016 and Electricity Rules and Regulations and general construction as per IS-8623-1993 as amended up to date and degree of protection shall be IP 42 as per 13947 Part- I.

7.1 Construction Features:

Distribution panels shall be fabricated out and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back. All removable/ hinged doors and covers shall be grounded by flexible standard connectors. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Joints of any kind in sheet

metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of Distribution panels. Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliolate or engraved metal name plates. All panels shall be provided with circuit diagram engraved on PVC sheet.

7.1.1 Bus Bar Connections:

Bus bar and interconnections shall be of high conductivity electrolytic grade aluminum/electric grade copper complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area to be added to the bus bar to compensate for the holes. All connections between bus bars and breakers shall be through solid copper / aluminum strips of proper size to carry full rated current and insulated with insulating sleeves. Maximum allowable temperature for the Bus bar to be restricted to 85 deg C.

7.1.2 Temperature - Rise Limit:

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

Cable Compartments

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

7.2. Standards and Codes:

The latest amended up to last date of submission of bid Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 2003 and Indian Electricity Rules 1956 as amended up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

7.3. Air Circuit Breaker:

The ACB shall conform to the requirements of IS/IEC 60947-2 and shall be type tested & certified for compliance to standards from–CPRI, ERDA/ any accredited international lab.

The circuit breaker shall be suitable for 433 V, 3 phase, 50 Hz supply system. Air Circuit Breakers shall be with molded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" "CIRCUIT HEALTHY" "SPRINK CHARGE" indications.

ACB should be able to carry Rated current as required in the SLD at the yearly maximum ambient temperature applicable for 50 degree centigrade and as per site condition whichever is higher.

ACB should have an operational designed voltage of 690 V for $I_{cs}=100\%$ I_{cu} for $I_{cw}=1$ Sec.

The ACB shall be 3/4 pole with modular construction, draw out, manually or electrically operated version as specified in SLD. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (ICS) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity (ICU) and short circuit withstand values(ICW).

Circuit breakers shall be designed to 'close' and 'trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Mechanical Contact wear indicator shall be mounted directly on the moving contacts to indicate the degree of erosion of the contacts. The ACB shall be provided with a door interlock i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

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

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall open after the main contacts open. Minimum 4 NO and 4 NC auxiliary contacts or as per BOQ requirement w.r.t Manufacturer shall be provided on each breaker. Rated insulation voltage shall be 1000 volts AC.

7.3.1 Cradle:

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

There shall be 3 distinct and separate position of the circuit breaker on the cradle. Racking Interlock in Connected / Test / Disconnected Position.

Connected Position: Main isolating contacts & control contacts of the breaker are Engaged

Test Position : Main isolating contacts are isolated but control contacts are still engaged

Isolated Position: Both main isolating & control contacts of the breaker are isolated

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

The following safety features shall be incorporated:-

- a) Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.
- b) Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.
- c) All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.
- d) All Switchgear module front covers shall have provision for locking.
- e) Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.
- f) Actual Contact Inspection should be possible by removing Breaker from the panel – with mechanism connected to moving contacts of ACB.

7.3.2 Protections:

The breaker should be equipped within built battery backup microprocessor LCD display based release to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following five zones:

Long time protection.

Short time protection with intentional delay.

Instantaneous protection.

Ground fault protection.

Neutral protection for 4 pole ACBs.

The protection release shall have following features and settings:

a. True RMS Sensing

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current.

b. Thermal Memory

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

c. Defined time-current characteristics:

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

d. Trip Indication

Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis. ACB should display last 20 trip history with date time stamping.

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

f. The setting range of release shall confirm to IEC- 60947 and its applicable sub-parts. All ACBs shall have over temperature protection of release.

All Incomer ACBs shall have temperature rise monitoring at cradle terminals and display thru protection release, LED/LCD display showing all Power & Energy Parameters (Currents, %loading, Voltages, Frequency, PF, Power & Energy (active, reactive & apparent) etc. All incomer ACBs shall have following additional protections other than mentioned above:-

Under and over voltage

Under and over frequency

Restricted Earth Fault protection

Trip Circuit supervision with PS class CT's.

Undercurrent, (for DG set only)

Reverse power (for DG set only)

Phase sequence reversal

Load shedding and reconnection thru programmable contacts.

Release should have LCD display for Power parameters.

Release should be able to capture short circuit current on which ACB has tripped. The trip and alarm shall be stored in memory with the date & time stamping along with type of fault and alarm.

Release should be self-powered.

Integral Test facility to test healthiness of release and the trip circuitry shall be provided on the Release.

Programmable digital contact shall be provided with possibility to configure for pre alarm like over load, over temperature etc, and trip functions like OL/SC/EF/OT etc.

7.3.3 Safety Features:

The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.

The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.

Draw out breakers should not close unless in distinct service/Test/Isolated positions.

The insulation material used shall conform to Glow wire test as per IEC60695.

The ACB shall provide in built electrical and mechanical anti-pumping.

7.4. Molded Case Circuit Breaker (MCCB):

7.4.1 General:

Molded-Case Circuit Breakers (MCCB) shall comply with IEC 60947-1 & 2 standards.

Earth Leakage Relay (30-3000mA) with CBCT shall be used for all outgoing MCCB.

Earth Fault shall be provided for all incoming MCCB.

MCCB shall be of category A with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (ICU) on all the ratings.

**MCCB shall have designed operational voltage upto 690 V AC (50/60 Hz).
MCCB shall have a rated insulation voltage of 690 V AC (50/60 Hz)
Indication lamp ON, OFF, TRIP shall be provided in incomer MCCBs and ACB.**

MCCB must be available in Microprocessor (250A and above) / Thermal Magnetic (Up to 200 Amp.) type release.

All MCCB should be fully rated up to 50 Deg C.

All thermal magnetic MCCBs up to 160A shall be adjustable thermal and fixed magnetic type and 200A shall be adjustable thermal and adjustable magnetic type ($I_r = 0.8 \times I_n$ to 1.0).

For microprocessor shall have following characteristics:-

MCCBs shall be permissible for mounting in all 3 axes (Vertical Wall, Laterally Rotated Wall and Ceiling & Floor mounting) without any adverse effect on electrical performance. It shall have line load reversibility.

7.4.2 Construction and operation:

For maximum safety, the power contacts shall be insulated in an enclosure made of a thermosetting material from other functions such as the operating mechanism, the case, the trip unit and auxiliaries.

MCCBs shall be actuated by a toggle or handle that clearly indicates the three positions: ON, OFF and TRIPPED.

The operating mechanism shall be designed such that the toggle or handle can only be in OFF position (O) if the power contacts are all actually separated & in OFF position, the toggle or handle shall indicate the isolation position.

MCCBs shall be equipped with a "push to trip" button in front to test operation and the opening of the poles.

The MCCB should have a trip-free mechanism that ensures the trip process is not prevented even if the operating mechanism is blocked or manually held in the "ON" position.

The Microprocessor Release MCCBs should be equipped with non-saturable type CTs for reliable & accurate protection.

All microprocessor based MCCBs should have display with battery back-up.

All microprocessor based MCCBs should have precise current setting in one step.

7.4.3 Current Limit & Selectivity:

MCCBs shall be Current Limiting type.

MCCBs, the current ratings of which are identical with the ratings of their trip units, shall ensure selectivity in rated current interval 1:1.6

-MCCBs shall be equipped with a test facility of the Release by a hand-held device.

7.4.5 Accessories:

MCCBs shall have uniform Internal Accessories platform across the range

MCCBs Door Mounted Extendible Rotary Handle shall have an option of Illumination Kit to indicate three stable mechanism positions (ON, OFF and TRIPPED).

MCCBs with TMTU Release should have provision for separate Short Circuit Signal facility.

MCCBs shall be snap fit type to enable safe on-site installation of auxiliaries, voltage releases, signal contacts etc.

MCCBs should have symbols engraved in the lid of the accessories compartment to indicate possible mounting position of internal accessories.

The addition of a motor module or manual rotary handle etc. shall not block device settings.

MCCB shall be equipped with Phase barrier, tinned copper spreaders.

7.4.6 Communications:

All incomers ACBs & MCCBs in main LT panel and distribution panel shall be BMS compatible in open protocol.

7.5. Moulded Case Circuit Breaker (MCB):

Miniature Circuit Breaker shall comply with IS/IEC 60898-1:2002 & EN 60947-2 or IEC-60947-2. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be C curves. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

7.6. Meters:

7.6.1 The digital meters shall conform in all respects to International standards –IEC 62053-21-22 or the relevant Indian standards, RoHs compliance with latest amendments thereof.

All voltmeters and indicating lamps shall be through Control MCB's.

Meters and indicating instruments shall be flush type.

All CT's connection for meters shall be through Test Terminal Block (TTB).

CT ratio and burdens shall be according to connected instrument and load.

7.6.2 Digital Multi-Function meter shall be provided in all incomers in main LT panels and distribution panels as shown in SLD, having following characteristics:-

Digital Electronic multi-function meter with RS-485 port with THD with individual harmonics up-to 31st order and THDi to measure and display the following electrical parameters:-

Total active energy(KWH/MWH),

Maximum demand(KVA/MVA)(KW/MW),

Maximum demand reset count,

Instantaneous power factor,

High/Low recording of VLL, VNL, A, Hz, PF, Var, with time stamp.

K factor V & A to keep check on the losses due to harmonic load current and their effects of transformer heating.

Load Manager with Demand monitoring and RTC based demand manager.
Export/Import Net monitoring of Wh, VAh, VARh, inductive/capacitive load hours.
Auto Scaling Capability in variance of Kilo, Mega, Giga.

Positive energy accumulation even with CT polarity reversal with reverse lock programmable.

Byte order option-Field Programmable float/Little Endian/Big Endian data formats.

7.6.3 Energy meter shall be provided in all outgoing in main LT panels and Metering main distribution panels having following characteristics:-

Monitors electrical parameters : Amps, W/VA, LLV, LNV, Hz, PF

Integrated Parameters :KWh /KVah, PF/Watt anyone programmable.

Old Energy register for back-up of last cleared energy values.

True RMS measurement with simulations sampling of current and voltage.

Color coded analog load bar indicators

CT Reversal : Auto correction of energy integration in Star (WYE) mode

Password protection for tamer proofing.

Site Selectable CT/PT.

Pulse output for integration into a process through PLC/DCS for online energy management.

Auto& Manual Scaling Capability in variance of Kilo, Mega, Giga

Seamless integration into any mod bus compatible SCADA- Energy Management System (EMS)

7.6.4 General Requirements:

CT polarity correction should be possible through Energy Meter for each phase. Import/ Export measurement for KWH/ KVARH is required.

The current inputs shall be configurable at site for measuring x/5/1 A current transformers

The meters shall be suitable for operation with AC auxiliary power and shall have wide tolerance band of 70V to 300V, 40-70Hz

The multifunction meters shall have backlit LCD display with power saving mode/ adjustable contrast.

7.7. Current Transformer:

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5/ 1 amps secondary for operation of associated metering. The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class as per SLD.

7.8 Residual Current Circuit Breaker (RCCB)

7.8.1 SYSTEM of Operation:

Residual Current Circuit Breaker shall conform to IEC 61008.RCCB shall work on the principle of core balance transformer. The incoming shall pass through the toroidal core transformer.

As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage; current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

RCCBs should have a rated conditional short-circuit current of 10 kA.

7.8.2 MECHANICAL Operation:

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

7.8.3 Neutral Advance Feature:

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

7.8.4 Testing Provision:

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB.

7.9 bus bar and internal wiring

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

Busbars shall be suitably colour coded and must be mounted on appropriate insulator supports. Power cables used shall have superior mechanical, electrical and thermal properties, and shall have the capability to continuously operate at very high temperatures up to 125 deg C.

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

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

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

7.10 Control Circuit & General Protection:

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

**An emergency stop push button shall be provided to trip the entire system (22.5 mm dia, mushroom type, press to stop and turn to reset).
Inspection terminal strip, number ferruling, labeling etc. shall be provided.
440 V caution board on the panel shall be provided.**

8. 00 Cable laying:

8.01 Cables shall generally be installed in cable trays except for some short runs in buried formation or in conduit / pipe for protection or crossing. Multi core power cable laid on trays & riser shall be neatly dressed & clamped with fabricated 25 x 3 mm G.S flat or cable tray at an interval of maximum 1 meter for vertical / inclined run & 1.50 meter for horizontal run. Control cables may be laid in single layer with touching formation. Power & control cables shall be claimed in separate group. Power & control cables shall be no be laid in a common tray excepting in very special case where a gap of 150 mm shall be maintained between power & control cables.

8.02 H.T & L.T power cables shall be laid in cable trays in single layer & with spacing equal to the diameter of cable.

8.03 Control cable can be laid upto a maximum of three layers in each tray.

8.04 Both power & control cables shall be clamped to the trays rungs by means of clamp made up to 25 x 3 mm fabricated G.S flat at an interval of 1500 mm for horizontal run & 1000 mm for vertical / inclined cable run.

8.05 The cable trays shall be run with a vertical spacing of 300 mm cable trenches. A minimum of 300 mm clearance shall be provided between the top of tray & beams, cold piping, 500 mm clearance for hot piping / object to facilitate installation of cables in tray.

8.06 Adequate pull boxes shall be provided in conduit run to facilitate. Cable pulling in long runs & also to ensure that there will be no more than 270 degree bend between the pull points.

8.07 Cable tray shall be installed to accommodate cable manufacture's recommended maximum pulling tension & minimum bending radius.

8.08 All opening in the floor & wall for cable access shall be sealed after installation of the cable system with non-inflammable materials.

8.09 All floor/ wall for cable entry to the electrical equipment & accessories shall be sealed with non-inflammable material, after completion of cable installation. Thickness of such materials shall be equal to the thickness of floor / wall.

9.00 Cable power & control:

9.01 The tender shall install & connect all power & control cable required for complete installation with in his scope of work. Type and size of power & control cable shall be as specified & as supplied under a separate sub section for power and control cable.

9.02 In general all power and control cable shall be run in cable trays in cable trenches. Isolated runs of control cables shall be run in rigid conduit.

9.03 Jointing of power cable should be avoided as per as possible. However, if any splicing of control cable is required to carry out interlock it will be done junction boxes not in the conduit or in the trays. Such junction boxes shall be in scope of tenderer.

9.04 The contractor shall not install cables with different voltage in the same cable tray.

9.05 During cable installation care shall be taken so that actually binding radius of each cable is not less than the one recommended by the cable manufacturer.

9.06 For cable buried directly underground their shall be a stone free sand cushion both above and below the cable run being held by brick wall support on two (2) sides. The excavated portion above the top sand cushion shall be covered by concrete precast slab supported on the side walls & finally filled up with standard back fill.

9.07 Cables shall be pulled into the trenches in strict accordance with the cable manufacture's instruction.

9.08 Tender shall furnish & install suitable solderless crimping type cable lugs at the termination of all wires & cables if not already furnished with the equipment.

9.09 All exposed conduits & armoured cables shall be tagged with numbers that appear in the conduit & cable schedules as prepared by the tenderer. All conduits & armoured cable shall be tagged at their entrance and / or exist from any piece of apparatus, junction box or pull box. Aluminum tags shall be used with the number engraved / punched on the tag. Tag shall suitable secured to the conduit or armoured cable.

The cable tags shall also be provided at all bends and at interval of 30 M on straight run of cable in order to facilitate the identification.

9.10 Laying termination & connection of all control cables for interlock, protection, indication & annunciation.

The tender shall prepare cable schedule & interconnection diagram & submit the same for approval of the Authority. Cable laying shall be started with the approval cable schedule & interconnection diagrams. Separate cables for each type of following services/ functions as applicable shall be used & laid along the run for each feeders.

- a) Power - designate as 'P'
- b) Control protection interlock, meeting, indication & annunciation designate as "C".

10.00.00 **Filed Testing:**

10.01.00 Filed testing shall be required for all the equipment & accessories furnished, installed or connected by the tenderer to ensure proper installation, setting, connection & in accordance with the plans, specification and manufacturer's recommendations.

Testing shall be conducted in presence of Owner's engineer with prior notice at least 2 weeks before commencement of any test.

10.02.00 Filed testing work shall be done as per the latest edition of the relevant standards. All tests recommended by the equipment manufacturer shall be conducted. The tenderer shall submit the list of all filed tests to be conducted for all equipment & accessories for review / approval by the owner.

10.03.00 Testing shall include any additional tests suggested by the owner that the deems necessary because of filed condition to determine that equipment, materials & system meet requirements of the specification.

10.04.00 The tender shall depute qualified personal to conduit all testing & shall provide all labour and testing equipment required for & incidental to testing.

10.05.00 The tender shall be responsible for any damage to equipment & material due to improper test procedure or test apparatus & shall replace to original condition of any damaged equipment or material.

10.06.00 The tender shall maintain in quadruplicate a written record of all tests showing date, personal making the tests, equipment or material tested performed & result. Two copies of test records shall be given to the authority.

11.00.00 **Commissioning:**

After the satisfactory test are performed the equipment & material shall be put non trial operation by the tenderer. After successful trial operation, the equipment shall be put on performance tests initially at no load condition & finally with different loading conditions.

ACCEPTABLE MAKES FOR INTERNAL ELECTRICAL INSTALLATION WORKS

S.No.	ITEMS	MAKES
1	MS Conduit (ISI marked)	BEC/AKG/NIC/Steel craft/ M-Key, SK (E.R.W)
2	PVC Conduit and accessories	Polycab/AKG/Asian
3	PVC/XLPE insulated aluminium/Copper conductor armoured/Unarmoured MV Cable upto 1100 V	Havells/Finolex/KEI/Grandlay/ Gloster
4	FRLS PVC insulated copper conductor stranded flexible wire i/c control cables	Havells/Finolex/KEI/Grandlay/RR Kabel/ Gloster
5	Cable Raceway floor/wall mounted and accessories	Schenider/Legrand/Cooper
6	Modular Switch & Socket	Legrand (Myrus)/M.K. (Element)/Schneider (Zencelo India)/Havells/ ABB
7	Metal clad Industrial Socket	Legrand/Siemens/Schneider/C&S/ABB
8	Cat-6 Cable	Beldon/Siemon/Legrand/Penduit (Pannet)
9	Cable Glands	Dowells/Commet/Gripwell/Raychem
10	Crimp Patch Cord	Beldon/Siemon/Legrand/Penuit (Pannet)
11	Protection Device (MCB/RCCB/DB/ELCB)	Siemens (Betagard),/Hager/Schneider / Legrand / C&S / ABB
12	MCCBs	Siemens (3VA)/L&T /Schneider/ Legrand / C&S / ABB
13	Power contactor	Siemens /L&T / Schneider / Legrand / ABB / C&S
14	Surge Protection Devices	Siemens/L&T/Schneider / Legrand
15	Panel Accessories	Siemens /L&T/Schneider / Legrand/Tecnic / ABB/ C&S/Neptune
16	Selector Switch	Salzer/Seimens /BCH/ Kacee
17	Auxiliary Relays	Siemens/L&T/Schneider/Legrand/ABB

18	LED/Metal Halide/Fluorescent Internal Lighting Fixture	Philips/ Wipro/Havells/Crompton/Decon
19	External Lighting Fixture	Philips/ Wipro/Havells/Crompton
20	Emergency Lighting/ Exit Sign boards	Philips/Havells/Lighting Technologies/Trilux/Prolite
21	Ceiling Fan (ISI marked & BEE rated 5 star)	Havells/Almonard/Orient/Usha/Bajaj
22	Paint	Nerolac/Asian/Berger
23	Advance Lighting Protection System (Early Streamer Emission Type)	LPI (Australia)-by allied power/SGI (Duval Messien/satellite (France)- by SGI/Bradlay (USA)- by JMV/Erico (USA)-by security shoppe/ABB
24	GI Pipe	Tata/Jindal/SAIL
25	Main LT Panels/ MCC Panel	(Main LT panel / MCC Panel board should be IEC 61439 part-1 and II manufacturer has to produces the relevant test certificate as per IEC code for the same failing which panel shall be rejected). Tricolite, Delhi /Siemens / Schneider/ Milestone/ Neptune
26	Air Circuit Breaker	Siemens / Schneider /L&T /Legrand/ C&S/ABB
27	Surge Voltage Protection	Siemens /Schneider/L&T/Legrand/ABB
28	Earth fault module	Siemens/Schneider/L&T/Legrand
29	Protection relays	Siemens/Areva/L&T/Legrand
30	C.Ts and PTs	Kappa/AE/Matrix
31	Digital Meters	Siemens (PAC)/ Schneider/ (conzerv) / Secure Enersol / L&T/ Neptune
32	Change Over Switch	L&T/Havells /Socomec/ABB/C&S
33	Indicating lamps	ESBEE/Schneider/Siemens/Vaishno/Neptune
34	Power capacitors	Epcos/ Neptune / Legrand /ABB/ L&T

35	Automatic Power factor correction relay/controller	Epcos/Siemens (PAC) /Schneider (Conzerv)/L&T/Neptune
36	Sealed Maintenance Free Batteries	Exide/Panasonic/Hitachi/Shinkobe
37	Battery charger	Caldyne/Chhabi Electricals/Statcon/Max Power
38	Cable Trays (Factory Fabricated/Overhead & Floor Raceways	Legrand/MEM/OBO/ Milestone/ Neptune
39	HDPE underground cable duct	Rex Polyextrusion/Tirpura/Plasomatics/Duraline
40	Insulation Mats	DL Miller & Co. Ltd. Premier Polyfilm Ltd./RMG Polyvinyl India Ltd/Jyoti
41	Smoke/Heat detectors	Apollo/ System Sensor/ Agni
42	Manual Call point	PRD/System-Tek/ Simplex/ System Sensor/Agni
43	Response indicators	PRD/System-Tek/ Simplex/ System Sensor/Agni
44	Fire Exit Signs	System-Tek/ Simplex/ Agni
45	Fire Control Panel	System-Tek/ Morley /Agni
46	Speaker / Hooter	System-Tek/ Philips /Agni
47	Occupancy Sensors/ Movement Sensor	Legrand/ Philips/ Wipro
48	Flush type switch /socket	Anchor/ Kinjal/ SSK/ Havells Reo
49	Fuse switches unit / switch fuse unit /HRC fuse	L&T / Siemens/ Havells/ C&S
50	Exhaust fan	Almonard/ Alstom/ Crompton/ Havells
51	XLPE insulated HT cables	Gloster /KEI/Havells
52	Cable lug	Ascon (Heavy gauge) Jainson Dowells
53	Lamp Holder (Brass)	Kay/SSK/Kinjal

54	Telephone wires/Telephone Cable / jelly filled telephone cables	Finolex /Delton/Havell's /R.R. Kabel
55	Telephone tag blocks	Krone/ Pouyet
56	Telephone outlet	MK Electric /Legrand (Mosaic)/Crabtree (Piccadilly)
57	GI raceways	Milestone Engineering /Legrand/MDS/Neptune Systems Pvt. Ltd./MK
58	PVC raceways	Legrand/ MK
59	Electronic ballast	Philips /Wipro/Bajaj/Decon/Crompton/Havells
60	DLP plastic trunking	Legrand/MK
61	Geysers	Recold /Venus /Usha Lexus /Sphere hot
62	Tower Light	Ligman/Simes/Bega
63	HT/LT transformers	ABB/Schneider /CGL (Crompton Greaves Ltd.)
64	HT SF-6 circuit breakers/VCB	Siemens /ABB/CGL/Schneider
65	Programmable Logic Controller(PLC)	Siemens/Allen-Bradley/Schneider
66	Earthing (Chemical Earthing) Plate Earthing	JMV/As per IWD Norms
67	Octagonal Pole	Bajaj / Crompton / Phillips
68	11 kV HT panel Incoming relay	CGL/Schneider/ABB/ Siemens
69	Control Relay Panel	CGL/Schneider/ABB
70	Lightning Arrestor	ABB/Alltec/JMV
71	Temp. Gauge	Guru
72	Gate Valve	Leader/Sant
73	Electrical Backup	Spare hot/ Racold

74	PVC Tank	Syntex/ Polycon
75	Thermostat	ISI Marked
76	Flat Collector Plate	Solocrome/ Tata BP/ Racold
77	S.S Sheet	Jindal / National
78	HT/LT cable joints (Straight through/outdoor/indoor)	3M/ Denson/ M Seal/Raychem/ Cabseal
79	Alternator	STAMFORD/Crompton Greaves
80	DG Set	Sterling & Wilson /Caterpillar/Commins Power / eneration/ Kirlosker
81	Makes of accessories of HT / LT Panel / Transformers	As per standard practice of manufacturer.
82	Bus Trunking	C&S / L&T/ Schneider as per standard practice of OEM manufacturer / channel partner
83	HT Panel 11 KV	ABB/Schneider /CGL (Crompton Greaves Ltd.)
84	Bus Duct	Neptune/ Milestone/Tricolite

Note: - Any item not mentioned herein shall be ISI marked and shall be as approved by the engineer-in-charge

FIRE DETECTION & ALARM SYSTEM

INTELLIGENT AND ADDRESSABLE FIRE DETECTION & ALARM SYSTEM

1. SCOPE OF WORK

- a. This specification outlines the requirements for an intelligent, addressable fire detection and alarm system.
- b. The work described in this specification consists of all labour, materials, equipment and services necessary and required to complete, test and commission the fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on drawings but required for proper performance and operation shall be provided and installed for a complete and operational system, by the contractor at no extra cost.
- c. The contractor shall furnish, and install complete and ready for intended use and operation, an intelligent, addressable fire detection and alarm system including Fire panel (s), initiating devices (manual pull stations, addressable smoke, heat detectors etc.) indicating devices (hooters, bells, visual warning signals, etc.) and supervisory devices, annunciators, wiring apparatus and accessories.
- d. The installation and locations of equipment and devices in the building shall be governed by the specifications and drawings with due regard to actual site conditions, manufacturers' recommendations, ambient factors affecting the equipment and other operations in the vicinity. If any departure from the specifications or drawings is necessary, approval shall be obtained from the Engineer-in-Charge before work is started thereon.
- e. Materials and equipment shall be new, first grade, standard, current models of the manufacturer and shall be suitable for this system. Where two or more pieces of equipment performing the same function are required, they shall be exact duplicates produced by the same manufacturer.
All materials, devices, and equipment shall be compatible with the circuits or systems in which they are utilized.
- g. The Contractor shall submit specific catalogue cuts for each of the item specified in BOQ for approval from Engineer in charge before procurement.

3. REQUIREMENTS

- a. This installation shall be made in accordance with the drawings, specification, local codes and local fire authorities having jurisdiction over this project.
- b. Reference Standards
 - i) The design, supply, installation, testing and commissioning of the entire fire detection and alarm system shall conform to BS:5839 or NFPA 71 and 72. The Detectors shall conform to relevant codes for Fire Alarm System.
 - ii) The system installed shall comply with the following codes/publications:
 - a) IS 2175
 - b) IS 2189
 - c) IS 11360
 - d) IS 732
 - e) UL "UNDERWRITERS" laboratory/NFPA/FM/VDS/FOC for addressable detector, fire panel.
 - f) EN 54
 - g) BS 5445

C. TESTS AT SITE

- i) All commissioning tests at site will be in line with BS : 5839 or NFPA 71 and 72.
- ii) Following test shall be conducted :-
 - i. Loop Checking
 - ii. Checking of smoke detectors, Heat detectors etc. by simulation.
 - iii. Functional tests for fire alarm panel.
 - iv. The Mock trial of the complete Fire Detection and Alarm system.

e. TESTS AT MANUFACTURER'S WORK

- i). Tests certificates will be furnished for approval of all Fire alarm devices and system devices.
- ii) All routine tests as per relevant codes for the Fire Alarm Panel, shall be conducted and results furnished to the Engineer-in-Charge.

5. POWER SUPPLY

- a. The control panel shall derive 230 Volts power from main supply. A standby power supply shall be immediately available in the event of failure of normal supply and shall automatically be connected so as to maintain the equipment in condition such that fire alarm originating from the operation of Detector can be given. The standby battery as secondary supply shall be such that when charged by associated battery charging equipment it can operate independently for a period of 12 hours. It shall have enough power supply to cope with additional load resulting in alarm originated from two separate zones for the one hour. Batteries shall be of Lead Acid type and sealed Maintenance free.
- b. Suitable arrangements shall be incorporated to prevent secondary batteries from discharging through the charging equipment in the event of its breakdown or a failure in the supply.
- c. In addition to the batteries, a battery charger suitable for operation on the auxiliary power available in the plant as specified above shall be supplied. The capacity of the charge shall be such that the same can boost charge the battery (within 8 hrs) while supplying the rated load of the fire detection and annunciation system. Facilities shall be provided to limit the voltage supplied to fire detection and alarm system to their rated values during the time of boost charging. The charger shall normally supply the battery trickle charging current and the DC load of the fire detection and alarm system. In case the AC supply on the input side of the charger fails the necessary power for the complete fire detection and alarm system shall be supplied by the battery.
- d. Visible and audible annunciation for troubles or failure in the power supply system like "charger Failure", "Battery Low Voltage", etc. shall be provided.
- e. Battery earth/fault indication/annunciation shall be included in the panel.

6. FIRE ALARM SYSTEM DEVICES

6.1 General

- i. Each device shall be assigned a unique address via easily understood decade (01 to 99) switch. Address selection via binary switches or by jumpers is not acceptable. Devices which take their address from their position in the circuit are unacceptable because if devices are later added, existing addresses, descriptors and commands need to be reprogrammed.
- ii. Devices shall receive power and communication from the same pair of conductors. For fault isolating modules a separate power wiring which shall be fault tolerant shall be provided.
- iii. Each device shall contain screw terminals with rising plates for positive termination suitable for 1.5 sq.mm. copper conductor wire.

6.2 Addressable Manual Stations

- i. Manual stations shall be of rugged die cast construction designed for semi-flush mounting. Plastic stations will not be acceptable. Stations shall be of the break-glass design and must be opened to be reset. Closing the box after opening it shall automatically perform the reset function. It shall be possible, for testing purposes, to

- initiate an alarm without breaking the glass. All stations shall be furnished with a spare glass break rod.
- ii. Provisions shall be made such that the address cannot be changed merely from opening the station.
- 6.3 Addressable Analog Detectors
- i. All fire sensors shall mount on a common base to facilitate the changing of sensor type if building conditions change. The base shall be incompatible with conventional detectors to preclude the mounting of a non-intelligent device.
 - ii. If the Fire Alarm Panel determines that the sensor is in alarm, the Fire Alarm Panel shall command the sensor LED to remain on to indicate alarm.
 - iii. Each sensor shall be capable of being tested for alarm via command from the Fire Alarm Panel.
 - iv. Each sensor shall respond to Fire panel scan for information with its type identification to preclude inadvertent substitution of another sensor type. The Fire Alarm panel shall operate with the installed type but shall initiate a mismatch (trouble) condition until the proper type is installed or the programmed sensor type changed.
Each sensor shall respond to Fire Alarm Panel scan for information with an analog representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end-to-end sensor including the operation of the sensor electronics. Systems which only monitor the presence of a conventional detector in an addressable base shall not be acceptable.
 - v. The Detector shall meet the requirements of either EN 54 or shall be listed with UL. It shall be possible to test the Detector's working both from the Panel as well as locally by means as designed by the Contractor and approved by the Engineer-in-Charge. The approved coverage per Detector for unhampered areas shall not be less than 50 sq. M. The detector shall be capable of being reset automatically after any alarm condition.
- 6.4 Addressable Analog Heat Detectors
- i. The Detector shall be Analog, Addressable Detector with its own manually set digital code and be able to give a single digitised output to the Fire Alarm Panel regarding its condition. The Detector shall employ the thermistor principle for heat sensing and the fixed temperature setting shall be at 60 degrees Centigrade. It shall be able to communicate with the Fire Alarm Panel by the Pulses emitted from the Panel.
 - ii. The Base of the Detector shall be interchangeable with other Smoke Detectors and the construction shall be of flame retardant material. LEDs shall be provided to indicate locally alarm condition.
 - iii. It shall be able to withstand temperature variations from 0o C to 50o C. Further, relative Humidity (non Condensing type) upto 95% shall not hamper its performance.
 - iv. It shall have in built safety device to monitor the removal and pilferage of the Detector. The Detector also must have facility for remote indication. The quiescent current flow must not exceed 50 milli amps. and alarm condition current shall be maximum 60 milli amps.
- 6.5 Alarm Hooters
- Alarm hooters shall be suitable for indoor, or outdoor, application with the appropriate 4 x 4 in. electrical box. All hooters shall be 24 V DC operated. The minimum sound level shall be 90 db at 10 feet. Hooters shall be surface semi-flush mounted.
- 6.6 Monitor Module
- i. The monitor module shall provide an addressable input for N.O. or N.C. contact devices such as manual stations, waterflow switches, sprinkler supervisory devices, etc.

- ii. It shall provide a supervised initiating circuit. An open-circuit fault shall be annunciated at the Fire Alarm panel (Subsequent alarm shall be reported.)
- iii. The device shall contain an LED which blinks upon being scanned by the Fire Alarm panel. Upon determination of an alarm condition of an alarm condition, the LED shall be latched on.

6.7 ADDRESSABLE CONTROL MODULE

- a) Addressable Control Module shall be provided to operate dry contacts for switching ON OFF Pressurisation fans, AHU' s etc. in case of fire etc.
- b) It shall have a built in type identification to automatically identify this device to the control panel.
- c) It shall have internal circuitry & relay powered directly by two-wire loop.

6.8 Fault Isolator Device

- i. The Fault Isolator Device shall detect and isolate a short-circuited segment of a fault-tolerant loop.
- ii. The device shall automatically determine a return to normal condition of the loop and restore the isolated segment.
The fault isolator device shall be placed every [20] devices to limit the number lost in the event of a short-circuit.

7 FIRE ALARM PANEL

Fire Alarm panel shall be provided with 80 character backlit Liquid Crystal Display (LCD) Annunciator, function key pad, and printer as specified below. Necessary software and hardware shall be furnished at the location shown on the drawings.

7.1 Automatic Functions

The alarm shall be displayed at the FP on an LCD display. The FP printer shall print out the same information displayed on the LCD display.

7.2 Manual Functions

At any time, the operator shall have the following manual capabilities at the FP by means of switches located behind a key locked cover:

- a) Initiate an alarm summary display on the FP LCD display. This display shall step through all currently active alarm in the system.
- b) Initiate a summary printout of all currently active alarms on the FP printer.
- c) Initiate an "all point summary" printout on the FP printer recording the status of each system point (initiating circuits, indicating circuits, etc.)
At any time the operator shall have the following manual capabilities at the FP under password control. Operator privileges and ID numbers of up to four digits shall be assignable only by the main operator or designated alternate. Actions taken by operators shall automatically be printed on the FP printer with operator initials, time and date.
- d) Command output points to different mode. Such commands shall be printed with selected descriptors
ON/OFF, ON/OFF/AUTO, OPEN/CLOSE, DAY/NIGHT, etc.
- e) Modify system parameters. Full alphanumeric key pad shall be provided for operators to modify the following parameters:-
change sensor alarm and prealarm thresholds
update date and time

- change point descriptions
- change action messages
- f) Select a system status report for printing on the FP printer. The following real time reports shall be provided:-
 - all point log
 - alarm summary
 - trouble summary
 - status summary
 - sensitivity log
 - disabled points log
 - isolated points log
 - disconnected points log
 - logical group points log

The sensitivity log shall print the analog value of each addressable analog sensor.
- g. Select printing of a trend log which, when enabled, shall print the last 24 analog values for every addressable analog sensor taken at predetermined intervals selected by operator. Systems which limit the number of addressable analog sensors which can be trended are not acceptable.
- h. Select a sequence of preprogrammed commands which shall be automatically executed, in sequence, via a single command. Provide a minimum of 255 commands which can be divide among a minimum of seven sequences.
- f. Perform a walktest function such that a single operator can periodically check out all initiating devices on a loop. In walktest mode all initiators on the selected loop shall automatically be isolated. As each device is placed into an alarm or trouble condition the FP shall print the condition and automatically reset the device. No audible signals shall be initiated from the loop to prevent disruption of building occupants. If a loop is inadvertently left in the walktest mode it shall automatically reset to normal after a five minute idle time is exceeded.

7.3 System Supervision

- a) In the normal supervisory condition, only the green "POWER" LED, and green "RUN" LED shall be illuminated. The LCD display shall display "System Normal" and the current time and date.
 - b) The LCD display shall indicate the loss of power condition and the printer shall record same. Following restoration to normal AC power, the trouble indicators shall be automatically reset, and the printer shall record the return to normal condition.
 - c) The LCD display shall indicate the loop in trouble and the printer shall record same. Operation of a momentary "Silence" switch shall silence the audible trouble signal, but the visual "Trouble" LEDs shall remain on until the malfunction has been corrected and the system reset. The FP printer shall record this action.
- The FP shall contain an integral backlit LCD display of two lines of 40 characters each, and a 40 character width printer. Both display and printer shall be viewable through the FP door.

7.4. Programming

The LCD display and printer programming shall be accomplished on-site by means of a lap-top personal computer which shall plug into the FP. Modules requiring off-site programming are not acceptable. Programming functions shall include alarm/trouble type assignment, point descriptor assignment, etc. Data file for the LCD display and printer shall be stored in EEPROM.

7.5 Networking

An additional output drive card must be provided to facilitate networking between two or more panels.

8. Approval of Fire Detection and Alarm System
The Contractor has to get the drawings for Fire Detection and Alarm System approved from the local fire authorities. On completion of the work, the Contractor has get the installation approved and obtain a certificate from the local fire authorities and handover the same to the Construction Manager. The contractor shall be responsible for obtaining the required approval from Tariff advisory committee and other statutory authorities.
9. Testing & Commissioning
 - 9.1 PHOTOTHERMAL SMOKE AND HEAT DETECTOR :
 - 9.1.1 The testing shall be carried out for each loop initially with one detector in a loop and subsequently two or more disassociated detectors in each loop with time gap between the detectors for alarm acknowledge and Reset.
 - 9.1.2. An identified smoke detector will be subjected to smoke aspiration from burning paper or cigarette puffs, held at 0.3 m distance from the detector. The panel should indicate through piezo sounder and hooter that alarm signal has been transmitted throughout the system. This test shall be carried out in different loops as well as two loops simultaneously. This part of the detector test shall be repeated again after 24 hours gap.
 - 9.1.3 The same test in the same sequence shall be carried out for heat detector but with the application of heat from a hair dryer-held at approximately 60 cm distance. Repeat testing of the same detector shall be carried out at 24 hours interval.
 - 9.2 Combined Test :-
 - 9.2.1 The panel shall be checked for basic tests, such as, visual checking of input voltage and amperage. All loops one by one, shall be D-wired to check for fault signal indication in the panel.
 - 9.3.2 Subsequently, in every loop of panel, a detector shall be subjected to smoke or heat test and signals shall be checked on the panel
 - 9.3.1 The hooter shall sound automatically and the piezo sounders shall also sound. It shall also be possible to check that the hooters of all panels sound automatically when the panels are auto moded.
 - 9.3.2 The power source shall be cut off and checked for standby supply from the batteries. After six hours the power source shall be switched on to check for auto switch over to mains mode. The trickle charger shall take over the charging of the battery to its maximum cut off level with auto cut off. A set of discharged batteries shall be connected to the panel in place of the new batteries and the trickle/boost switch checked for charging of the batteries.
 - 9.3.2 Tests shall be conducted for AC failure, charger failure, battery disconnected or battery failure. In all such cases the relevant indication should come and the sounder shall also sound alarm.
 - 9.4 Manual Call Box :
The manual call box glass shall be removed by unscrewing the back. The micro switch shall instantaneously give a fire signal in the panel.

9.5 Random Sample Testing :

About 5% of all fire alarm components shall be subjected to random testing by connecting to the panels. All smoke detectors shall be tested as given above and later cleaned with a vacuum cleaner. Hooters shall also be tested through direct 24V supply. It shall be tested for 10 minutes.

9.6 Testing of Earthing system:

The earth continuity conductor including metallic parts of the equipments shall be tested for earth to electrical continuity. All tests shall be carried out as per IS 3043 and resistance of complete installation shall not be more than one ohm.

9.7 COMMISSIONING AND ACCEPTANCE TESTS

The commissioning and acceptance tests shall be apart from the standard or routine tests prescribed and normally conducted by the manufacturer and will be irrespective of the fact whether the same are covered by such tests or not.

Each sounder circuit shall be energised separately and the sound level reading taken to check for conformity with the minimum standards.

b. Mains failure performance

c. Battery disconnection test.

d. Open circuit of each sounder circuit to be tested.

e. Short circuit of each sounder circuit to be tested.

f. The results of the above tests either by fault warning or fire alarm shall be recorded in the log books which will be signed both by the Consultant and Engineer in charge.

Contractor shall preserve the copies of invoices, test certificates, gate passes etcto prove the genuineness of material/purchases. The responsibility of procurement, genuine material of specialized works shall rest with the contractor.

No inspection outside the country is permissible if required so the same will be deemed to be waived off and necessary test reports shall be submitted before the dispatch of equipment.

LIFTS

LIFT ADDITIONAL SPECIFICATION

List work item details and specification for items to be used in addition to CPWD specifications

1. SITC of MR Gearless lift having contract speed & serving different floors in the lift shaft as per detailed specifications enclosed and as under:

Built in special features:

- a. Automatic Rescue Device- ARD Automatically takes the lift to the nearest level in the case of a power interruption.
- b. VVVF Controller: This world leading technology comes standard in all Sukranti Lifts. The Variable Voltage Variable Frequency (VVVF) control, ensures 50% energy savings. It also creates a super comfortable ride quality - when jerk- free starts and stops. Smooth acceleration and deceleration and no landing variations. Time after time. In the long run, this prevents wear and tear of components, which comes means less downtime and huge savings on spares.
- c. Stainless Steel Buttons: Sophisticated design - button flush with back plate. Orange LED illumination. Engraved numbers. Highly tamper resistant.
- d. Fireman Switch: To enable fire- service personnel to take over complete control over one or more lifts.
- e. VVVF Door Controller: Silken Smooth door movement. Advanced features like adjustable independent times for opening and closing. Slow -nudging features ideal for high traffic situations.
- f. Infra Red Screen Sensor: Curtain of 154 infra red beams to prevent accidental closing of the door.
- g. Infra Red Screen Sensor: Curtain of 154 infra red beams to prevent accidental closing of the door.
- h. Floor Height Car Fixture: Designed specially for high- rise buildings. With Press & Speak facility and overload indicator.
- i. Overload Indicator: When the lift is overloaded indicator light turns on and the alarm beeps.
- j. Door Frame: Only lifts come with elegant door frames in corrosion - resistance, pre-coated steel that gives strength as well as an enlarged appearance.

13 PASSENGER LIFT SPECIFICATIONS

Type Of Lift	PASSENGER
Load / Speed	13 Persons (884Kgs.) / 1.0 Mtr. Per Second
Drive	MICRO PROCESSOR BASED VVVF
Travel / PIT / HEADROOM	28 METER/ PIT 1800mm/ HEADROOM 4800 mm
Number Of Floors	(G+5) 6 floors
Floor Display Char	0,1,2,3,4,5
Number Of Landing Entrances	6 (G+5)
Number and Position of Car Entrances	1 (ONE), IN FRONT ONLY
Position Of Machinery	Directly Above the Lift Well- Gearless
Size of Lift Well	2500 X 1900 X (MM Wide * MM Depth * MM Height * MM E- Value)
Lift Car Inside Size	2000 X 1100 X 2200 (MM Wide * MM Depth * MM Height * MM C-Value)
Clear opening of Gates / Doors / Lintel	900 X 2000 (MM Wide * MM Height) Lintel - 2200 mm .
Type or Design of Lift Car	STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH -
Additional Specification	As per CPWD specification and relevant IS code
Car Ceiling - Car Floor	SLEEK (SMALL CIRCULAR LIGHTS) - SS HAIRLINE FINISH -PVC
Car Fittings	LED LIGHTS & CROSS FLOW - FAN
Type Of Car Front Entrance Protection	POWER OPERATED CENTRE OPENING SLIDING DOOR -STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH
Land Entrance Protection (0,1,2,3,4,5)	SIDE/ CENTRE OPENING SLIDING DOOR - STAINLESS STEEL (1.5 mm) – HAIRLINE FINISH

Landing Door Frame (0,1,2,3,4,5)	STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH
Type Of Control System	MICROPROCESSOR BASED SIMPLEX SELECTIVE COLLECTIVE CONTROL WITH / WITHOUT ATTENDENT
Electric Supply	AC 3 PHASE, 50 CYCLES, 415 VOLTS \pm 10%
Brail button	Yes
Automatic rescue device	Yes

BED LIFT SPECIFICATION

Type Of Lift	(BED LIFT)
Load / Speed	26 Persons (884Kgs.) / 0.55 Mtr. Per Second
Drive	MICRO PROCESSOR BASED VVVF
Travel / PIT / HEADROOM	28 METER/ PIT 1800mm/ HEADROOM 4800 mm
Number Of Floors	(G+5) 6 floors
Floor Display Char	0,1,2,3,4,5
Number Of Landing Entrances	6 (G+5)
Number and Position of Car Entrances	1 (ONE), IN FRONT ONLY
Position Of Machinery	Directly Above the Lift Well- Gearless
Size of Lift Well	2500 X 3000 X (MM Wide * MM Depth * MM Height * MM E- Value)
Lift Car Inside Size	1600 X 2400 X 1200 (MM Wide * MM Depth * MM Height * MM C-Value)
Clear opening of Gates / Doors / Lintel	1200 (MM Wide * MM Height) Lintel - 2200 mm .
Type or Design of Lift Car	STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH -
Additional Specification	As per CPWD specification and relevant IS code
Car Ceiling - Car Floor	SLEEK (SMALL CIRCULAR LIGHTS) - SS HAIRLINE FINISH -PVC
Car Fittings	LED LIGHTS & CROSS FLOW - FAN
Type Of Car Front Entrance Protection	POWER OPERATED CENTRE OPENING SLIDING DOOR -STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH
Land Entrance Protection (0,1,2,3,4,5)	SIDE/ CENTRE OPENING SLIDING DOOR - STAINLESS STEEL (1.5 mm) – HAIRLINE FINISH

Landing Door Frame (0,1,2,3,4,5)	STAINLESS STEEL (1.5 mm) - HAIRLINE FINISH
Type Of Control System	MICROPROCESSOR BASED SIMPLEX SELECTIVE COLLECTIVE CONTROL WITH / WITHOUT ATTENDENT
Electric Supply	AC 3 PHASE, 50 CYCLES, 415 VOLTS \pm 10%
Brail button	Yes
Automatic rescue device	Yes